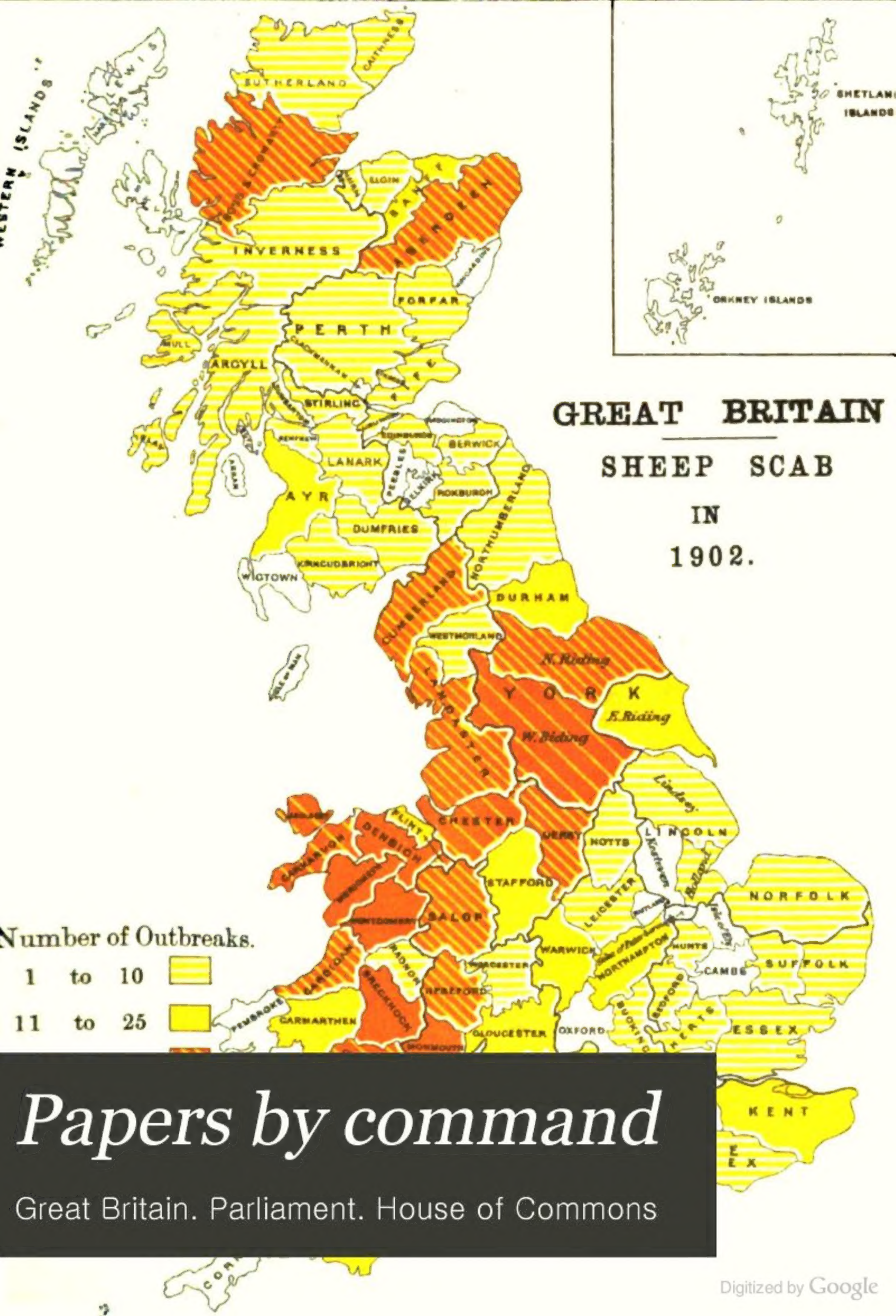

GREAT BRITAIN

SHEEP SCAB

IN

1902.

Number of Outbreaks.
1 to 10
11 to 25
SHETLAND ISLANDS
ORKNEY ISLANDS
WESTERN ISLANDS
LEWIS
CAITHNESS
SUTHERLAND
ROSS & CROMARTY
ELGIN
NAIRN
BANFF
ABERDEEN
INVERNESS
KINCARDINE
FORFAR
PERTH
MULL
ARGYLL
CLACKMANNAN
KINROSS
FIFE
STIRLING
DUMBARTON
RENFREW
BUTE
ISLAY
ARRAN
HADDINGTON
EDINBURGH
LINLITHGOW
BERWICK
LANARK
PEEBLES
SELKIRK
ROXBURGH
AYR
DUMFRIES
KIRKCUDBRIGHT
WIGTOWN
NORTHUMBERLAND
CUMBERLAND
DURHAM
WESTMORLAND
ISLE OF MAN
N. Riding
YORK
E. Riding
W. Riding
LANCASTER
Lindsey
LINCOLN
Kesteven
Holland
ANGLESEY
FLINT
DENBIGH
CARNARVON
CHESTER
DERBY
NOTTS
MERIONETH
STAFFORD
SALOP
MONTGOMERY
LEICESTER
RUTLAND
NORFOLK
Isle of Ely
CARDIGAN
RADNOR
WARWICK
Soke of Peterborough
NORTHAMPTON
HUNTS
CAMBS
SUFFOLK
WORCESTER
HEREFORD
BRECKNOCK
PEMBROKE
CARMARTHEN
GLOUCESTER
MONMOUTH
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# REPORTS
FROM
COMMISSIONERS, INSPECTORS,
AND OTHERS:

TWENTY-SEVEN VOLUMES.

—(9.)—

AGRICULTURE (BOARD OF);
BUTTER COMMITTEE; FORESTRY.

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1903

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FROM

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AND OTHERS:

1903.

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ANNUAL REPORTS

OF

PROCEEDINGS

UNDER

THE DISEASES OF ANIMALS ACTS, THE MARKETS AND FAIRS (WEIGHING OF CATTLE) ACTS,

ETC., ETC.,

FOR THE

YEAR 1902.

Presented to both Houses of Parliament by Command of His Majesty.

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CONTENTS.

Page.

Report of the Chief Veterinary Officer—
- Contagia—Contagium 4
- Diseases of Home Stock during 1902 12
- Outbreak of Foot-and-Mouth Disease in the United States, 1902 18
- Diseases in Foreign Animals imported during the year 1902 18

Report of the Assistant Secretary, Animals Division—
- Foot-and-Mouth Disease 19
- Swine-Fever 22
- Sheep-Scab 27
- Glanders 30
- Anthrax 30
- Rabies 30
- Casualties in the Cattle-carrying Trade 34
- Markets and Fairs (Weighing of Cattle) Acts, 1887 and 1891 36
- Appendix I. 37
- Appendix II. 39

List of Orders in operation on the 1st January 1903 ... 43

List of Ports in Great Britain where Foreign Animals may be landed 46

Statistical Tables 47

International Trade in Animals 75

Maps showing cases of Swine-Fever in 1900, 1901, and 1902, *between pages* 26 and 27.

Maps showing cases of Sheep-Scab in 1900, 1901, and 1902, *between pages* 30 and 31.

TO THE PRESIDENT OF THE BOARD OF AGRICULTURE.

SIR,

I HAVE the honour to submit to you herewith reports, by the Chief Veterinary Officer (Mr. A. C. Cope) and by the Assistant Secretary, Animals Division (Mr. A. W. Anstruther), of the proceedings under the Diseases of Animals Acts, 1894 and 1896, and the Markets and Fairs (Weighing of Cattle) Acts, 1887 and 1891, for the year 1902.

The usual Statistical Tables relating to Home and Foreign Animals are appended.

I have the honour to be,
Sir,
Your most obedient Servant,
T. H. ELLIOTT,
Secretary.

31st March 1903.

Annual Reports of Proceedings under the Diseases of Animals Acts, the Markets and Fairs (Weighing of Cattle) Acts, etc., etc., for the Year 1902.

REPORT OF THE CHIEF VETERINARY OFFICER.

Contagia—Contagium.

Contagia—Contagium.

It may confidently be asserted that no subject in medicine has of late years commanded so much attention on the part of scientists, and the members of the medical and veterinary professions, or so interested the general public as the investigations which have been made into the cause, propagation, and means of transmission of the various contagious and infectious diseases of man, and animals.

Congresses have been held, especially in connection with tuberculosis in man and animals, in almost every capital in Europe, at which the foremost men in science have expressed their views on the subject of the *contagium* of that disease. The medical and veterinary journals have teemed with articles bearing upon this important question, and the daily and other papers have so familiarised the public with all the proceedings and views expressed at those meetings, that at the present time almost every reading member of the community begins to hope that the day is close at hand when the human and animal races will be protected, if not freed, from some of the more serious diseases of a contagious and infectious character. A careful consideration, however, of the work which has already been done cannot but make us recognise that as yet we have only touched upon the fringe of this most complex subject.

Probably no better definition of the terms *contagia* and *contagium* has yet been offered than that given by Sir John Simon, one of the ablest writers and greatest authorities upon human

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Contagia—
Contagium.

sanitary science, who held the post of Medical Officer to the Privy Council prior to the establishment of the Medical Department of the Local Government Board. His definition is as follows:—

> "The word *contagia* is applied in pathology to the property "and process by which, in certain sorts of diseases, the affected "body or part causes a disease like its own to arise in other bodies "or other parts; and the Latin word *contagium* is conveniently "used to denote in each such case the specific material, shown or "presumed, in which the infective power ultimately resides."

More than a hundred years have passed since Jenner proved in 1796, in a practical manner, that the *contagium* of cowpox was capable of being transmitted by direct inoculation from one human being to another. He performed his first operation upon a boy with material obtained from the hands of a milkmaid who had contracted the disease from cows affected with cowpox. Referring to this great and important discovery, which has conferred one of the greatest blessings on the human race, M. Pasteur made the following remarks when addressing the members of the International Medical Congress, held in London in the year 1881, on the subject of the work he had carried out in connection with the inoculation of animals as a means of protecting them against virulent disease:—

> "I have given to the term vaccination an extension which "science, I hope, will accept as a homage to the merit and "immense services rendered by one of the greatest men of "England—Jenner. What a pleasure for me to do honour to this "immortal name in this noble and hospitable city of London."

But in Jenner's time, and for many years after, the cause of contagious diseases, both in man and animals, remained unknown, and until the microscopist and the bacteriologist appeared upon the scene all diseases of an infectious nature were commonly attributed to the presence of something in the air, or in the blood of the diseased man or animal.

Indefinite, however, as these expressions undoubtedly are, they were the outcome of the practical experience gained and observations made during periods when contagious diseases were prevalent. It had been constantly observed that certain diseases of man of a communicable nature prevailed in various localities, and that people became affected with those diseases without any known cause, while others were traced to the introduction of a diseased person. Although the actual cause of contagious diseases was then unknown, the scientist of the present day has demonstrated that in regard to some of them the views of our forefathers were correct.

One of the first investigators in this field of science was Pollender, a physician, who resided, in the year 1844, at Wipperfurth, in Germany. It was he who discovered the presence of some minute objects in the blood of animals which had died of anthrax, to which were given the term *bâtonnets*, but not appreciating at the time that these *bâtonnets* were in any way connected with the cause of that disease, he regarded them as minute

Contagia — Contagium.

blood-crystals. Some twenty years later (1863), Dr. D
who was then engaged in medical practice in Paris, and ha
a pupil of the celebrated Professor Rayer, the founder
school of comparative medicine in that city, being much im
by M. Pasteur's studies on lactic fermentation, realize
possibly these *bâtonnets* which had been observed by Po
might really be living organisms.

It was however left to Dr. Koch of Berlin, to contin
inquiry, and he ultimately proved not only that these *bâ*
could be cultivated in suitable media, but that in their
spores were formed, and further, that with these culti
he could produce anthrax in healthy animals.

This discovery on the part of Dr. Koch annihilat
preconceived ideas as to the nature and the cause of anthr
at the present time no one questions the fact that it is a
due to the access of the now well-known bacillus into the
of animals or man.

Dr. Koch's further discovery of the bacillus of tuberculo
entirely changed the views previously entertained as to th
of that disease, which in the case both of men and anim
regarded as mainly due to heredity. It has now been
strated that it is produced by a specific *contagium*, so tha
the former theory precluded all hope of eradicating this
our present knowledge leads us to believe that it mi
successfully dealt with by the application of rigid h
principles, and consequently the disease has now been d
of many of its horrors.

Among the other early workers in this direction was Dr. Vi
Professor at the Military School of Medicine of Val de G
Paris, who in the year 1865 discovered that if the *con*
contained in the tuberculosed parts of a diseased anima
introduced into a healthy rabbit the same disease would be
duced. A few years later Professor Chaveau, the well-
and distinguished French veterinarian, achieved the same
by feeding a healthy rabbit on parts of an animal affecte
tuberculosis.

These researches have been carried out not only with the
of discovering the *contagium* of each communicable dise
also for preparing, by attenuation or otherwise, a material
therefrom which has the power to cure a diseased animal
protect a healthy animal from becoming infected in the or
manner. As the knowledge obtained on this most im
subject has not hitherto been compiled in such a manne
be easily available, it is proposed in this Report to describe
what briefly, what has already been done in this direct
connection with the contagious diseases of animals.

The subject of *contagium* is one of great interest
Veterinary Department of the Board of Agriculture beca
the measures adopted for the suppression of contagious dise
animals are necessarily based upon a knowledge of th
which regulate the spreading of those diseases.

Contagia—Contagium.

The diseases which are specifically mentioned in the Diseases of Animals Act, 1894, are cattle plague, pleuro-pneumonia, foot-and-mouth disease, sheep-scab, sheep-pox, and swine fever. To these have been added anthrax, glanders, and rabies.

Cattle plague has rarely visited Western Europe, and therefore the opportunities for studying that disease have been few and of short duration. It is, moreover so fatal, at least to the cattle of this country, that should it reappear it would be absolutely necessary to extinguish the disease as rapidly as possible by slaughtering not only all cattle that may be affected, but those which have been exposed to infection.

During the past century there have been three outbreaks of cattle plague in this country; the first occurred in the years 1865-67, the second in 1872, and the third in 1877. The first outbreak found the country entirely unprepared with any kind of veterinary organisation, and as a result the disease spread all over Great Britain before any serious steps were taken to arrest its progress. The losses during this outbreak, which took nearly two years to eradicate, have been estimated at not less than 400,000 cattle, all of which died or were slaughtered. The second, however, which occurred in 1872, was extirpated in a few months—under the direction of the Veterinary Department of the Privy Council—while the third was also promptly stamped out. Although the outbreaks have been of short duration in Great Britain, a serious outbreak occurred in France in the years 1870-72, when the disease was brought in the wake of the German army and continued after peace was declared. Germany having doubtless drawn some of her supplies of cattle from farther east, where cattle plague was at that date more or less constant. The disease spread to 43 departments, and the returns published by the French Government, which were admitted to be incomplete, and far below the true amount, show that besides 40,000 which died 56,000 other cattle which had been in contact were slaughtered to arrest the progress of the disease.

The appearance of the disease in Great Britain in the year 1865 was no less disastrous. It spread over the country rapidly, and within the short space of six months after its introduction it is computed that as many as 9,500 cattle were attacked in a week, and two months later the number increased to 17,750 in the week, of which 12,000 died.

These serious losses naturally caused great alarm, not only among the agriculturists, many of whom were absolutely ruined, but also among the public. In view, therefore, of the gravity of the position, and of its national importance, the Government appointed a Royal Commission to inquire into the cause and nature of the disease. The commissioners consisted of large landed proprietors who had great interests at stake, practical agriculturists of repute, and one member of the veterinary profession, the late Professor Spooner, who was then principal of the Royal Veterinary College in London, the present Earl Spencer being chairman of the Commission. One of the first steps taken was to appoint several special commissioners, of whom five were distinguished members of the medical profession, to

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Contagia—Contagium.

report on the nature, progress and symptoms of the cattle plague, and the modes of its propagation. Each commissioner prepared a report on the particular subject relegated to him, but those which have the greatest bearing upon the subject under consideration in this Report were written by Professor (now Sir) J. Burdon Sanderson and Dr. Lionel Beale.

As a result of experiments carried out at the Albert Veterinary College, London (where he was ably assisted by my late colleague, Mr. Duguid), Sir J. Burdon Sanderson discovered that the blood of cattle affected with cattle plague contained a poison (*contagium*) which has the power to infect healthy cattle 48 hours after they have been inoculated with virulent blood, by which time the temperature of the inoculated beast rises from the normal 102° to 105°·2. From this result he came to the conclusion that cattle plague was essentially a blood disease, and this view accords with the ante and post-mortem appearances present in cattle that have died of that disease, of which the most prominent are high fever with superpurgation, the alvine excretions of the affected animal being frequently streaked with blood, together with intense congestion of the blood-vessels throughout the intestinal track.

Dr. Lionel S. Beale, to whom was relegated the duty of microscopical research, expressed the opinion "that there could " be no doubt that the *materies morbi* or *contagium* consisted of " minute particles so light that they might be wafted long " distances," and he also stated in his report that " although he " had examined the various tissues of the body with a $\frac{1}{50}$ lens, " having a magnifying power of 2,800 diameters, he could find no " definitely formed substance that could with certainty be said " to be the cause of cattle plague."

The early development of the *contagium* in the system of an animal, as ascertained by Sir J. Burdon Sanderson, accounts for the rapidity with which this disease is spread; and the fact pointed out by Dr. Lionel Beale, that the affected animal not only exhales the *contagium* from the respiratory organs, but also expels it from the digestive system, emphasises the danger of keeping alive diseased cattle, or any other which have been in contact with affected animals, or exposed to infection.

Nearly 40 years have passed since the reports referred to were published, and it is of interest to find that the views therein expressed as to the existence of the *contagium* in the blood of animals affected with cattle plague has been confirmed by Dr. Koch and others during their inquiries into the disease in South Africa. In a most interesting report on the subject of rinderpest in South Africa, by Mr. Duncan Hutcheon, Colonial Veterinary Surgeon to the Government of Cape Colony, which appeared in the *Journal of Comparative Pathology and Therapeutics*, Vol. XV., Part 4, December, 1902, the following important remarks are made on the subject of the prevention of infection:—

" The defibrinated blood of an animal which has recovered " from the cattle plague gives a temporary immunity against the " disease, but, in order to increase the immuning power of the

Contagia—Contagium.

" serum, it becomes necessary to add a small quantity of virulent " blood. There is no doubt that fortified serum possesses strong " curative properties when used in the early stages of the disease. " Its curative action is, however, beyond dispute when it is used " in sufficiently large doses."

In the case of the Cattle-Plague we have a disease in which the *contagium* has never been discovered, but the scientist, having demonstrated that it exists in the blood-stream, has utilized his knowledge to devise a means for preventing and curing one of the most fatal diseases affecting horned stock.

Pleuro-Pneumonia is an infectious disease of a febrile nature affecting animals of the bovine race alone. The lesions, as its name implies, are confined to the lungs and their immediate covering, and though the *contagium* has not been discovered, it is of importance to note that the disease has never been conveyed by any other means than the introduction of a diseased animal into a herd. Another feature of interest in pleuro-pneumonia is the fact that it is not communicated by the secretions or the excretions of diseased animals, and that the infective properties of the *contagium* apparently cease with the death of the animal. Recent bacteriological researches, conducted on a somewhat novel method by MM. Nocard and Roux, lead them to believe that the organism of this disease does exist in the fluid exudate so abundant in the lungs of cattle affected with pleuro-pneumonia, and, although it is only just visible when magnified 2,000 times, it can be cultivated in liquid media, and is as capable of setting up a similar inflammatory process in connective tissue when injected into an animal, as the inflammatory liquid which saturates the lungs of an animal affected with pleuro-pneumonia. Indeed it is stated that these artificial cultures have been successfully used as a protective agent. The mode of cultivation consists of filling small collodion capsules with sterile bouillon to which is added a small quantity of the inflammatory liquid obtained from the lung of an animal affected with pleuro-pneumonia. The capsule after being closed is placed into the abdominal cavity of a rabbit, and when examined after a period of two to three weeks the liquid is found to have become slightly opalescent.

In the absence, however, of any information as to the number of experiments conducted, and of the necessary details of the result of the post-mortems of the cattle to which immunity is supposed to have been given, we have yet to learn whether this agent is of any practical value. Unfortunately the opportunities for continuing these inquiries no longer present themselves in France, because pleuro-pneumonia has of late years been practically eradicated in that country by adopting the system of stamping out the disease which has been attended with such remarkable success in Great Britain.

Foot-and-Mouth disease, except for its non-fatal character, in many respects resembles cattle plague. The *contagium* develops in the animal very rapidly, and fever is sometimes present on the second or third day after infection. The *contagium* is present not only in the fluid contained within the vesicles

Contagia—Contagium.

which appear upon the mucous membrane of the mouth and particularly of the tongue, but also in those upon the teats, the udder, and the feet. It is also exhaled in the breath of the affected animals, and is capable of being disseminated by the excretions. One of the peculiar features of foot-and-mouth disease is that it is communicable to all animals of the bovine, ovine and porcine races. In Germany, where foot-and-mouth disease is constantly present in some parts of the country, to the great loss of agriculturists, a very considerable sum of money has been expended in the endeavour to discover the *contagium*, but without any marked success. The rapid development of fever in the healthy animal soon after it becomes infected suggests, as in the case of cattle plague, that the *contagium* exists in the blood, but from the most recent investigations into the *contagium* of foot-and-mouth disease which have been conducted in Berlin by a commission appointed for the investigation of that disease, this view does not appear to be correct. The experiments referred to were carried out at the Institution for Infectious Diseases by Prof. Dr. Loeffler and Prof. Dr. Frosch. In their report which was published in 1897 they state that bacteriological methods have failed to detect any specific organism, that the culture media inoculated from the contents of the vesicles, which were kept under observation for several weeks, remained as a rule absolutely free from any bacterial growth, and in those instances in which bacteria did develop it was perfectly obvious that they resulted from bacteria which had accidentally gained access to the culture vessels; and further that none of the attempts to cultivate the hypothetical agent of the disease yielded successful results. But, in spite of this negative result of bacteriological inquiry, it is stated in the Report that the lymph from the vesicles did actually contain the cause (*contagium*) of foot-and-mouth disease as was evident from the fact that calves and yearlings which were inoculated with portions of the same material on the mucous membrane of the mouth developed typical vesicles after two or three days. Experiments were also made with a view of producing the disease in calves by injecting the serum of the blood taken from the jugular vein of a diseased animal during the period of vesicle formation, but they failed in each case, and, as a result of numerous experiments, it was ascertained that the only certain method of infection is the introduction of the virus contained in the vesicles into the blood-stream.

Attempts were made to protect animals from this disease by inoculation with a mixture of the lymph taken from the vesicles and the serum of the blood of animals recovered from the disease, but the experiments were carried out upon so small a scale, and the results obtained were so varied and uncertain, that the question of obtaining immunity by this process remains in abeyance.

The *contagium* of Glanders and that of anthrax have long ago been detected. In both these diseases it has been found to exist in the form of a bacillus, each having the power to reproduce its specific disease if introduced into healthy susceptible animals. The former is known as the bacillus mallei, and the latter as the bacillus anthracis. The discovery of the bacillus of glanders has

Contagia—Contagium.

been utilized in the production of mallein, a substance which has proved to be a most effective agent for diagnostic purposes, but its curative properties would be extremely difficult to determine, because it was found from the post-mortem examination of the horses recently used while conducting the experiments on glanders for the Board that there was a tendency on the part of some of them to recover from that disease, *vide* p. 15. It would therefore be extremely difficult to decide whether a horse which reacted had recovered from glanders owing to the frequent application of mallein, or to natural causes.

The discovery of the Anthrax bacillus derives its chief interest from the fact that its detection by Dr. Koch has greatly stimulated the study of bacteriology, and has undoubtedly led to a more extended application of what is termed protective inoculation of animals. A vaccine has been prepared from the organism of anthrax which is largely used in France, but the ordinary incidence of anthrax is so varied that it is difficult to decide as to its protective value, and experience at least in this country goes to show that in the majority of the outbreaks the disease does not recur in the same farm even if no protective agent is employed.

Swine-Fever is another contagious disease affecting animals the *contagium* of which has been determined by bacteriological research.

The etiology of Swine-Fever has been a subject of study for many years by Dr. Klein in this country, Dr. Salmon and Dr. Smith in America, and Professor Schutz, Director of the Berlin Veterinary High School, all of whom regard this disease as being due to a bacillus. In the years 1895–7 the disease was investigated from a bacteriological point of view by a Departmental Committee appointed by the Board of Agriculture to inquire into the etiology, pathology, and morbid anatomy of swine-fever. In the first Report issued by that Committee [C. 8023] Professor McFadyean, Principal of the Royal Veterinary College, announced that he had isolated a bacillus present in the mesenteric glands of pigs in all instances where the infection has taken place by way of the digestive system, which is the cause of the disease, and as a proof of the correctness of this opinion he pointed out that he had been able to produce typical lesions of swine-fever in healthy pigs with cultivations which were the ninth remove. This investigation has entirely set at rest the question as to the *contagium* of swine-fever.

In the year 1887 a report was issued by the American Government which is not without interest, as it contains the results of inquiries and investigations into the history, nature, and treatment of "hog cholera," the name given to this disease in America. All the lesions depicted in the plates contained in that report are identical with those present in the swine-fever of this country, and the inquiries made in America went to show that the disease in question was due to a *contagium* which assumed the form of a bacillus, and that the bacillus might be kept alive in clear river water for from two to four months, while stagnant pools were still more dangerous.

Contagia—Contagium.

The report contains records of experiments dealing with the period during which the bacillus may retain its infective power in the soil, and points out that being a non-sporulating organism, it is very tenacious of life, and that disinfection must necessarily be difficult in cases where the organism is spread upon the soil. In one experiment it was found that it retained its power to infect if sown in moist soil, for a period extending from two to four months. Experiments were also conducted to determine the disinfectant properties of various compounds, and the report states that lime has many advantages over others, for not being poisonous it can be used with impunity, where mercuric chloride or strong acids are inapplicable, and it does not injure the soil, is cheap, and always obtainable.

As in the case of Small-Pox in man, the *contagium* of Sheep-Pox has yet to be discovered. This disease has been introduced into this country upon very few occasions, and has therefore been seen by very few veterinarians in England.

In regard to Rabies, it was for many years believed that the *contagium* of that disease existed only in the saliva of the affected animal, but M. Pasteur has experimentally demonstrated that it is also present in the structure of the brain and the spinal cord, and that by a special method of drying the cord the virus of the disease becomes attenuated, and when thus prepared can be used as an anti-toxin for hydrophobia in man.

Diseases of Home Stock during 1902.

Diseases of Home Stock during 1902.

The animals of this country have been unusually free from contagious diseases during the year 1902. There has been only one outbreak of foot-and-mouth disease; glanders shows a slight decrease, not only in the number of counties infected but also in the number of outbreaks and of horses attacked. No case of pleuro-pneumonia has been detected since 1898, and while swine-fever has been reduced very considerably in Ireland, the number of outbreaks in Great Britain has decreased from 3,140 in 1901, to 1,688 in 1902. Sheep-scab has slightly increased as regards the number of outbreaks, but the number of animals reported as having been attacked is somewhat less than in the previous year. On the other hand, a recrudescence of rabies has occurred, 13 cases having been confirmed by the officers of the Board while only one was recorded in 1901. Anthrax has been reported from eight more counties than in 1901, and the outbreaks have increased by 27, the total number of animals reported to have been attacked being 1,032, against 971 in 1901.

The same mystery exists as to the origin of the outbreak of foot-and-mouth disease which broke out at Chislet in the county of Kent in March, as in many of those which occurred in the two preceding years. At the time when this centre was discovered no known case had existed in any part of England since April in the previous year (1901), and it therefore seemed improbable that it could have originated from any other case in this country. A somewhat extensive outbreak had occurred in the same county several

Diseases of Home Stock during 1902.

miles distant some fifteen months before, in which a large number of cattle and sheep were involved, but nothing even of a suspicious nature had arisen in that county during the interval.

The disease on this occasion appeared among a flock of ewes with lambs in a remote village a few miles from Herne Bay. The animals had a short time before been pastured on the marshes, and it was at first thought by the owners that they were suffering from foot rot, but as the disease gradually extended among the sheep after they had been removed to high land where the whole flock had been put upon a change of soil and food, and some of the lambs had died—the outbreak was reported by the police to the Board. As on previous occasions, a considerable amount of doubt was expressed as to the disease being foot-and-mouth, but the diagnosis of the Board's veterinary officers as to its nature was soon set at rest by the appearance of the disease in a marked form in two cattle which were kept in a yard adjoining the field where the affected flock had been placed. Fortunately, the particular part of the farm to which the flock had been removed was surrounded by arable land, and therefore afforded ample opportunity for effective isolation. This was carried out, the owner having expressed a desire that the sheep should not be slaughtered if it could possibly be avoided, as he had bred from the flock for years, and set considerable value upon the animals. The disease passed somewhat slowly through the flock, a large proportion of which became affected, more especially in their feet, while a few had lesions also in the mouths, but it was not until after the expiration of seven weeks that the restrictions were withdrawn. Before this was carried out the feet of all the animals were washed and carefully disinfected under the supervision of one of the Board's veterinary staff. During the time the restrictions were in force, inquiries were made throughout the county to discover whether any other centres existed, fortunately without success.

It is impossible to pass over this solitary outbreak without making some comments as to its possible origin. The day has long since passed when any person of experience would suggest that it could have arisen spontaneously, and the fact that the disease appeared among the cattle, as well as the sheep, disposes of any doubt as to its nature. It was hoped that by prohibiting the landing of animals from all countries in which foot and-mouth disease existed we should have secured an absolute immunity from that disease. The total prohibition against the landing of animals from the continent of Europe has been in force since 1894, and for a period of five years after, *i.e.*, from 1895 to 1899, no case was detected in Great Britain, although the disease was very prevalent on the continent. In view of these facts it is obvious that the *contagium* of the disease must have been conveyed to this country from abroad by some medium, but prolonged inquiries in every conceivable direction have failed to afford any clue as to its origin.

Little is known as to the period during which the contagium of foot-and-mouth may retain its power to infect animals under ordinary climatic conditions and without the intervention of the

Diseases of Home Stock during 1902.

diseased animal. Long experience has taught us that it can be and often is conveyed by persons who have recently been in contact with animals affected with the disease in its vesicular and active stage, but the most common mode of its extension is doubtless the movement of infected stock. In connection, however, with what may be termed the agency of inanimate objects, some important facts have come within the knowledge of the Board which are worthy of record. Some years ago when foot-and-mouth disease was very rife in the cattle market at Deptford, and at a time when the United States was free from disease, some cargoes of cattle were found to be affected with this disease at the time of their arrival in the ports of Liverpool and London from America. The matter was made a subject of enquiry and for a long time without success, but it subsequently transpired that it had been the practice on the part of the men in charge of the cattle imported to take back to the States the head ropes which had been kept for some days in Deptford cattle market and to use them again for other consignments on their next journey. It was therefore surmised that these head ropes had become infected in the Deptford market and had thus been the means of conveying the disease to the healthy cattle brought in succeeding vessels. The surmise proved to be correct because immediately the practice was abandoned and new ropes supplied, each succeeding cargo arrived healthy.

Again, in the year 1881, a cargo of cattle arrived from the United States having on board several animals affected with foot-and-mouth disease. The vessel, after landing her cattle in this country, proceeded on her next voyage to Canada, where she shipped, at the port of Halifax, in Nova Scotia, 287 cattle and 130 sheep. Canada had never been infected with foot-and-mouth disease, but on the arrival of the ship at the port of London it was found that no fewer than 137 cattle and 64 sheep were affected.

In those days vessels did not make such rapid passages as at the present time, and a period of not less than 18 to 20 days must have elapsed between the date when these vessels left the port of London and took a fresh cargo of animals on board. In both of these instances therefore the *contagium* must have retained its power to infect for not less than 18 days. These cases illustrate the importance of carrying out a most rigid system of disinfection not only of all premises but also of all substances that have been in contact with animals affected with foot-and-mouth disease.

Glanders.—In accordance with the recommendation of the Departmental Committee appointed in the year 1899 to report upon the working of the Diseases of Animals Acts in so far as they relate to glanders, a special professional Committee was appointed by the Board in 1901, which had for its objects :—

I. To ascertain whether an apparently healthy horse which has reacted to mallein (a reactor) is capable of spreading the infection of glanders under ordinary circumstances.

II. To ascertain whether an apparently healthy horse that has first reacted to mallein and subsequently ceased to react (a ceased reactor) is capable of spreading the infection of glanders.

Google

Diseases of Home Stock during 1902.

In order to pursue these inquiries, and that the experiments necessary should be carried out on premises free from any contamination with the virus of the disease, two large sheds which had never been occupied by horses were obtained. Into one shed were placed eight horses which were presumably healthy, *i.e.*, had not reacted to the mallein test, and to these were added six horses which had reacted but did not present any clinical evidence of glanders at the time they were mixed with the other horses. All these horses were turned loose in the shed, they were fed from the same mangers and drank from the same troughs, they were kept in contact and under daily observation for various periods, in some instances extending to 55 weeks.

One of the eight presumably healthy horses which had been in the stable for 16 weeks was slaughtered on account of injury, and proved on post mortem to be glandered, but the other seven remained clinically healthy up to the time of their slaughter although they had been in daily contact in some instances for the period mentioned, viz., 55 weeks.

In another stable five horses which had reacted on several occasions to the mallein test, and had subsequently ceased to react, but had not at any time prior to purchase shown any clinical evidence of glanders, were placed loose in a shed with six presumably healthy horses, where they were detained and kept under similar conditions as to feeding and watering as in the previous experiment.

In this experiment some of the horses were kept in contact for a period of 53 weeks, and when they were ultimately slaughtered a post-mortem examination was made and any lesions having a resemblance to glanders nodules were subjected to cultural and inoculation tests. None of these horses developed any clinical evidence of glanders, nor was there evidence of active glanderous disease in any of them when killed.

The points of greatest significance which have arisen out of these experiments are :—

I. That although a horse may react to mallein it does not necessarily follow that he will develop glanders in a clinical form.

II. That the infective power of horses that are only known to be glandered as a result of their having reacted to mallein is very low.

III. That the horse which is known as a "ceased reactor" does not appear to be a source of danger to healthy horses.

IV. That glanders in the horse is a disease in which there is a tendency on the part of many animals to recover. Finally, it may be asserted that it is the clinically affected horse which is the chief source of danger.

A report giving a description of these experiments has been issued by the Board in the form of a Parliamentary paper [Cd. 1396].

Google

Diseases of Home Stock during 1902.

The re-appearance of Rabies in a group of counties, including three in South Wales and one in the West of England, although somewhat disappointing, need not be regarded with any alarm, because there is no reason whatever to doubt that the measures which have been so successful in exterminating that disease in every other part of the country will ultimately be effectual in that district.

The returns of Anthrax show a slight increase in the outbreaks of animals attacked, but it cannot be said that they afford any correct evidence of the extent to which that disease really exists in Great Britain. In the first instance, it is well known that numbers of cattle affected with anthrax are slaughtered without the owner being acquainted with the nature of the disease from which they were suffering. Such cases are therefore never returned. On the other hand, it is equally well known that errors are not infrequently made in diagnosis. In some districts in England it has become customary to send an ear removed from each animal suspected to have died of anthrax to an expert veterinary bacteriologist or to the public analyst for examination, and it has frequently been found after making a microscopical examination of the blood that the bacillus of anthrax has been absent. If this system were extended the returns forwarded would give a more correct idea as to the extent to which anthrax prevails, but at the present time the returns are quite untrustworthy.

Swine-Fever.—During the year 1902 the Veterinary Inspectors throughout Great Britain have forwarded to the laboratory 2,999 morbid specimens from pigs which have been slaughtered in consequence of their having been suspected of or affected with the above disease, and as a result of the examination of these specimens the lesions of swine-fever were discovered in 1,688 instances.

A careful and minute examination has been made by the veterinary officers of the Board of all the parts sent, but it cannot be said that anything has been added thereby to our previous knowledge of pathology or morbid anatomy of this disease.

A very considerable amount of very useful work has been carried out by the newly-appointed veterinary staff which has of late been added to the Department. Since their appointment they have been largely employed in following up and tracing the origin of outbreaks of this disease, and by carrying out post-mortem examinations of the carcases of pigs which have died from some unknown cause, they have been able to discover the origin of some outbreaks which had been altogether inexplicable. One of the greatest obstacles which presents itself in connection with the eradication of swine-fever is that centres of disease may, and often do, exist for days and weeks before any intimation thereof is brought under the notice of the Board. In some instances the owners fail to report through their ignorance of the nature of the disease from which their animal or animals have suffered. In others they seem to prefer to put up with the loss of a few pigs of small value rather than expose themselves to the inconvenience which arises from the application of the restrictions necessary for eradicating the disease on their premises.

Diseases of Home Stock during 1902.

When dealing with a disease which is capable of being transmitted by other means than the movement of the affected animal, it is imperative for success, that each centre should be known as soon as it arises otherwise the virus of that disease may be distributed for long distances unknowingly by individuals who may have been in contact with the living diseased animal or its excretions. Undoubtedly the success which has of late years attended the action taken by the Board in preventing the extension of foot-and-mouth disease has been chiefly due to the early reporting of each centre. This early information has enabled the Board to rapidly apply restrictions prohibiting movement of animals in the district, and also to secure the isolation of those affected. Unfortunately in the case of swine-fever there are many instances in which pigs are affected for days and sometimes die of the disease which never come to the knowledge of the Board.

Sheep-Scab.—Legislation for this disease has been in force since the time of George III., and it is only reasonable to infer that it must have caused serious losses as far back as the end of the 17th century. Following upon the success which has attended the measures adopted by the Department for the extinction of all the more serious contagious diseases of animals, it is only natural that the owners and breeders of sheep should now be urging the Board to take an active part in an attempt to extinguish sheep-scab. The Returns received from the local authorities during the last 26 years indicate that a considerable amount of progress has been made in the direction of controlling sheep-scab in this country, the outbreaks which amounted to 3,214 in 1877 having been reduced to 1,654 in 1902. While it is fully recognized that the introduction of the disease into a flock of healthy sheep is a most serious matter to any flock master, it must be admitted that there are some sheep owners who think but lightly of it, and the neglect of the few to take even the simplest precaution in the direction of preventing or curing the disease is a serious menace to the interest of the general body of graziers. The Returns received by the Department appear to indicate that scab exists in only 38 English counties, but it is difficult to explain why Cambridge, which is credited with a sheep population of 191,038, Cornwall with 387,556, Hants with 346,300, Oxford with 227,617, and Rutland with 78,828, should remain free from scab, indeed it may be reasonably assumed that the disease does exist in at least some of them, but the owners have failed to report the fact to the local authorities.

Of the three divisions of Great Britain, Wales may be regarded as the most seriously infected, and while in Scotland scab has been returned from nearly every county during 1902, in only four has the number of outbreaks exceeded 10, and in only five has the number of sheep attacked exceeded 100. With a disease so widely spread at the present time in Great Britain it is obviously necessary that if any serious attempt is to be made to eradicate scab the measures adopted must be uniform in character, and to be successful they should also be applied in Ireland where the number of outbreaks returned (to say nothing of those which are not reported) are not very far short of those in all England. This is a point worthy of consideration in view of the fact that we import about a million sheep from Ireland every year.

Outbreak of Foot-and-Mouth Disease in the United States, 1902.

Outbreak of Foot-and-Mouth Disease in the United States, 1902.

An unexpected outbreak of foot-and-mouth disease was discovered in Massachusetts and Rhode Island in November, 1902. The Department of Agriculture first received an intimation of the existence of this disease on November 14th, 1902, in a letter from Dr. Austin Peters, Chief of the Cattle Bureau of Massachusetts. This letter stated that a disease resembling foot-and-mouth disease had been discovered in Rhode Island, and that an investigation would be immediately made and the results reported. On November 17th Dr. Peters telegraphed that he believed the malady to be foot-and-mouth disease. Upon receipt of this telegram Dr. John R. Mohler, Chief of the Pathological Division of the Bureau of Animal Industry, was at once sent to Massachusetts to investigate and report. He reported in a letter received November 24th that the disease was probably the European foot-and-mouth disease, and gave sufficient details as to symptoms and nature to allow an intelligent opinion to be formed. As there was no history of the introduction of affected animals into the United States, and a declaration of the existence of the disease would have such serious consequences in commercial restrictions, it was deemed advisable to have additional expert opinions. Dr. Leonard Pearson, Dean of the Veterinary Department of the University of Pennsylvania, and Professor James Law, Dean of the New York State Veterinary College, were at once asked to proceed to Massachusetts and give an opinion as to the nature of the disease. Their final report was received November 27th, and on the same day quarantine orders were promulgated by the Department.

It appeared that the disease had existed in Massachusetts since August. It had extended over the eastern part of that State and into Rhode Island, and, as investigation subsequently showed, into Vermont and New Hampshire.

After carefully considering the conditions which existed, and the enormous loss with which the country was menaced by the spread of the contagion, it was decided to slaughter the diseased and exposed animals as soon as this could be done, and to disinfect thoroughly the buildings in which they had been sheltered. This policy has been carried out, and at this time all affected animals, so far as known, have been destroyed, and the infected premises have been or are being disinfected.

Diseases in Foreign Animals Imported during the Year 1902.

Diseases in Foreign Animals Imported during the Year 1902.

There has been a not unimportant falling off in the amount of animals imported during the year 1902, amounting to 76,000 cattle and 90,000 sheep. Compared with the previous year the decrease has been chiefly in the American trade, while Canada has increased her exports of cattle by about 4,000. The only disease detected by the inspectors at the ports has been scab in sheep. Of 100 sheep found to be affected 98 came from the United States of America, and two only from Canada.

ALEX. C. COPE.

31st March, 1903.

REPORT OF THE ASSISTANT SECRETARY, ANIMALS DIVISION.

The following Report upon the work of the Animals Division for the year 1902, is submitted.

Foot-and-Mouth Disease.

Foot-and-Mouth Disease.

Foot-and-mouth disease reappeared in Great Britain upon the 27th of March after a period of freedom from that disease of nearly one year, the presence of disease in the parish of Chislet, Kent, being confirmed by the Board's Veterinary Officers upon the following day (Good Friday).

The stock on the farm consisted of 336 ewes with their lambs and two cows. Strict precautions were promptly taken to isolate the infected herd, but after full consideration slaughter was not resorted to. The premises were ultimately declared free from disease seven weeks later. No case of the disease was reported from any other premises in the neighbourhood.

Searching investigations were instituted with a view to discover the origin of the outbreak, without eliciting any definite clue to the source of contagion. The fact that foot-and-mouth disease was at the time prevalent in Western Europe is, however, sufficient to account for its introduction into Great Britain, although the agency, whether of persons or things, by which it was actually conveyed remains unknown.

The area over which restrictions were applied was of necessity a wide one, and the period of the year at which the precautionary measures became necessary was, from the point of view of Kentish stockowners, a specially inconvenient one. The contingent loss to farmers in the district was admittedly very considerable.

The administrative action taken formed the subject of discussion by a deputation of agriculturists from the locality which waited upon Mr. Hanbury at the House of Commons on the 30th of April.

As regards the general policy followed in such cases enough has been said in former Reports. Briefly, the restrictions adopted have been proved to be an efficient protection against the general spread of foot-and-mouth disease in the locality in which the disease is detected. The necessity for the imposition, in such circumstances, of stringent restrictions upon the movement of stock is not seriously contested. The points at issue are the

Foot-and-Mouth Disease.

degree of stringency necessary to attain success and the size of the district over which the restrictions should apply. The more immediate sufferers not unnaturally desire the minimum of restrictions, but the enormous interests at stake as regards the country as a whole render the gradual evisceration of admittedly successful procedure to the point at which failure begins a course which those primarily responsible for the effective suppression of the disease naturally hesitate to adopt.

No reasonable person can maintain that stock from holdings in the immediate vicinity of infected premises should be permitted to move freely and come in contact with other animals, and it is to be noted with regret that a member of the deputation above referred to (in making the point that the Board's Order had not come into operation in time to prevent the holding of the Canterbury Market on Saturday the 29th of March), admitted that he had met the owner of the infected herd, who was his near neighbour, on his way to report his first suspicion of disease to the police, and on hearing his news at once arranged, in anticipation of the restrictions, to send sheep from the immediate vicinity of the infected premises to that market. In the face of actions prompted by such a complete absence of public spirit the Board are to a large degree powerless, but if a proceeding of that kind is one which should in future be guarded against, the size of the area over which restrictions are applied would have to be enlarged rather than contracted. Happily there is little reason to suppose that agriculturists as a class would in similar circumstances set their private gain above their obligations of good citizenship, and it is satisfactory in this connection to place on record the loyalty and public spirit with which the large majority of Kentish farmers supported the Board in a difficult task.

In the month of April foot-and-mouth disease was detected in a small herd of cattle in the Island of Guernsey, and it became necessary to prohibit for the time being the importation into Great Britain of animals from the Channel Islands. The disease ultimately spread to only one other set of premises in the same Island, and in the month of November it became possible to allow the trade to be resumed in its entirety, the recommencement of the trade to Great Britain from the Island of Jersey having been authorised early in June, and that from the Island of Alderney at the end of July. In view of the close proximity of the Channel Islands to the northern and north-western Departments of France in which foot-and-mouth disease was at the time very prevalent, and in which it is recurrent, the introduction of that disease into Guernsey is not a matter of very great surprise. Although the proposition has been disputed, it seems not unreasonable to attribute the outbreak to the importation into Guernsey of fodder from France, a proceeding which is not permitted in the case of Jersey. So long as the Guernsey Authorities permit this trade to continue, it is clear that stockowners in Guernsey will be liable at any moment to find their trade in animals with Great Britain interrupted.

Foot-and-Mouth Disease.

A matter of wider interest was the discovery of the existence of foot-and-mouth disease in the New England States of the United States of America in the month of November. This discovery led to the prohibition of the importation into Great Britain of animals shipped from ports in those States, which prohibition continued in force at the close of the year. The Federal Authorities of the United States of America adopted prompt measures to regulate the movement of animals both within the States scheduled by them and out of those States to other parts of the North American Continent, with apparently satisfactory results, though sufficient time has not yet elapsed to enable it to be stated with confidence that the outbreak has been got entirely under control. No information is available as to the source to which contagion is attributable.

The fact that vessels had left New England ports with cattle prior to the passing of the Prohibition Order, but subsequently to the first appearance of the disease, exposed this country to a risk of the importation of foot-and-mouth disease by means of the animals so carried, and against this risk it became the duty of the Board to adopt special precautions. In their action in this respect they were most loyally assisted and supported by the majority of shipowners concerned who, in spite of the expenditure in which they might thereby have become involved, readily agreed to submit the animals carried to veterinary inspection on board the vessel at the earliest possible moment after arrival off the coast of Great Britain, and who undertook, if disease were detected, to send the vessel, after discharging the animals, again to sea for a thorough preliminary cleansing before entering the docks for the discharge of the remaining cargo. Happily in the nine cargoes so landed no disease was found, and by the end of the year the more immediate danger had ceased to exist.

The Board are greatly indebted to the owners of Foreign Animals Wharves for their ready co-operation in this important matter.

The necessity for maintaining the prohibition against the importation into Great Britain of animals from the Argentine Republic and the neighbouring South American States continued throughout 1902, the laws of the Republic for the prevention of the introduction and spreading of disease not being, in the opinion of the Board, such as to afford the full security contemplated under Section 25 of the Diseases of Animals Act, 1894. The question of the amendment of those laws formed the subject of negotiations between the two Governments which resulted in the initiation of proposals for their amendment, and by the close of the year the matter appeared to be in a fair way to settlement.

It has been asserted that the rise in the price of meat which occurred at home during the year was a direct consequence of the prohibition of the landing in Great Britain of Animals from Argentina. The attitude of the Board in this respect is governed by statute, but that it was not to such prohibition that the rise

Foot-and-Mouth Disease.

in price is attributable, is shown by the following figures comparing the live and dead meat imports from Argentina for the year 1902 with those for 1899, the last full year in which live cattle from Argentina were accepted for slaughter at our ports.

——	1899.		1902.
		Cwts.	
Live cattle	85,365 = about	615,847	Nil.
Live sheep	382,080	221,743	Nil.
Fresh beef	150,368 cwts.		923,748 cwts.
Fresh mutton	1,141,208 "		1,352,501 "
Total about ...	2,129,166 cwts.		2,276,249 cwts.

These figures show that the amount of beef and mutton imported from Argentina in 1902 was about 7 per cent. greater than in 1899.

The predominant factors in the rise of the price of meat in Great Britain have, without doubt, been the shortage of the supply from the United States of America, due largely to the failure of the maize crop the year before, and in a lesser degree the shortage of the supply from Australia, due to the continued drought in that continent.

This is borne out by the figures, viz. :—

——	1901.	1902.
United States of America—		
Live cattle	405,704	324,431
Live sheep	300,152	233,227
Fresh beef	3,180,291 cwts.	2,290,465 cwts.
Australia—		
Fresh beef	243,348 "	65,860 "
Fresh mutton	518,639 "	279,134 "

Swine-Fever.

Swine-Fever.

It is satisfactory to record that the number of outbreaks of swine-fever in Great Britain for the 52 weeks ended December 27th, 1902 (the statistical year), fell to 1,688 as compared with 3,140 in the corresponding period of the previous year. Since the Board commenced their operations against this disease in 1893

Swine-Fever.

the lowest returns for corresponding periods had been 2,155 in 1897 and 1,940 in 1900. The figures for 1902 show, therefore, a decline of 252 outbreaks as compared with the lowest figures previously recorded.

During the summer months it became apparent that, if the returns received truly represented the position as regards disease, the position was as favourable as it had ever been since the task of eradicating swine-fever was first undertaken. Not only were the outbreaks of the disease fewer in number, but there appeared to be signs that the disease was in some degree localised. It became, therefore, a matter for serious consideration whether advantage should not be taken of the opportunity which presented itself to initiate more vigorous action on the lines adumbrated in the Report of last year.

All experience goes to show that in operations against contagious diseases in animals the best results are obtained by means of the restriction and regulation of the movement of animals likely to have been exposed to the infection of the disease; and in swine-fever it has been found that a very large measure of safety is secured where the movement of swine from district to district is confined to those which have been in the same ownership for 28 days before movement, it being a condition of such movement that on arrival at their destination the swine are detained, and as far as possible kept isolated from other swine, for a further period of 28 days.

Local Authorities have power to protect their own districts by adopting Regulations prescribing the above requirements, and where this course has been adopted good results have followed, more especially in cases in which the Regulations included well-considered restrictions on the general movement of swine within the district of the Local Authority.

As instances of this, the experience of the Counties of Cheshire and Somerset may be of interest.

In Cheshire, a county which is credited with a pig population of 67,148, and is in an especial degree dependent upon a supply of store swine from without, a rise of outbreaks of swine-fever has usually followed the general movement of swine in the early summer months. In the year 1901, 98 outbreaks were confirmed in the months of April, May, June, and July, out of a total for the year of 140. The Local Authority, however, decided, in addition to the restrictions on movement into their district from without mentioned above, to adopt Regulations regulating the movement of swine within the county (otherwise than for breeding purposes, for which special provision was made), unless the swine had been on the premises from which they were to be removed 28 days and remained upon the premises of destination (provision being made for those passing through a market under licence) for a further period of 28 days. In the months of April, May, June, and July of the year under review only 15 outbreaks of swine-fever were confirmed in the county, and the total

Swine-Fever.

number for the year was reduced to 39. In 1894 the total number of outbreaks of swine-fever in Cheshire was 370, whilst the lowest yearly total previously recorded was 118.

In Somerset, with a pig population of 118,407, swine-fever was present to an alarming degree at the time when the Board first commenced operations, 641 cases having been confirmed in the year 1895. The disease was more rapidly got under some control than in other districts, the outbreaks falling to 204 in 1896 and 44 in 1899. In 1900 and 1901 the figures rose again to 97 and 95 respectively, and the Local Authority determined to try the effect of rigid restrictions as to the movement of swine into the county. The restrictions adopted prevented the movement of any imported pig until it had been detained on premises in the county for 28 days, the movement of swine for immediate slaughter being restricted to animals duly marked and conveyed, so far as movement on a highway in the county was concerned, in a waggon, cart, or van. The public markets in the county have also been closed for the sale of store pigs. Only 39 outbreaks were confirmed in 1902, and it is significant that of these only one outbreak occurred in the last quarter of the year.

In view of these facts the Board determined to recommend generally to Local Authorities action on similar lines. This course was taken in preference to direct action on the part of the Board, because it was held that in such matters the Local Authority were best able to judge the special needs of their own district, and to adjust their Regulations, within certain well-defined lines, to the trade of their locality. Regulations suitable to a district in which the necessity for the importation of swine is small could not properly be applied to a dairying district in which a large importation of store swine is essential at certain periods of the year, or to a bacon curing district in which the importation of large numbers of swine for immediate slaughter is a necessity of trade. On the other hand, it was not felt that the position would justify the enforcement by the Board of restrictions throughout the country of a general character designed to meet the more extended demands of the importing districts, contrary to the wishes of the Local Authorities in the non-importing districts.

The County of Wilts (pig population 55,430) was one of the first to fall in with the proposals, and Regulations on the lines of those of Cheshire, but with a special modification as regards the admission of swine for immediate slaughter, were adopted in the month of June. The outbreaks of swine-fever which in 1901 had risen to 177, after four years of comparative freedom from disease, have again fallen to 54, of which only four occurred in the last quarter of the year.

It rapidly became apparent that, with a very few regrettable exceptions, Local Authorities were ready to fall in with the views of the Board in this matter so far at any rate as movement of swine into their districts was concerned, and in these circum-

Swine-Fever.

stances it was thought desirable to frame, for the assistance and guidance of Local Authorities, a set of Regulations designed to carry out the objects in view, of which a copy will be found in the Appendix to this Report, page 30.

By the close of the year the large majority of Local Authorities in England, Wales, and the South of Scotland, had decided to adopt Regulations framed on these lines.

In this connection it may be placed on record that the County of Ayr have adopted a modification of the Regulations as regards the movement into that district of swine by dealers, whereby any pig dealer who elects to register himself as such is permitted to bring the swine by licence to his premises, and to remove them again within the period of 28 days to other premises in the district. The Local Authority will, however, register those dealers only who undertake to keep each consignment of swine separate, to keep on a prescribed form a register of swine received and their distribution, and whose premises are suitable. These arrangements proved most valuable in checking and quickly bringing under control an extensive series of outbreaks of swine-fever which occurred in that county in the summer months, and which were directly traceable to recently imported swine. They are well worthy of the consideration of other Local Authorities, and have since been adopted by the Local Authority of Huntingdonshire.

It is confidently anticipated that if Local Authorities will maintain and energetically enforce their Regulations, a very decided step forward will be made in the direction of combating and eliminating swine-fever. Past experience shows that Local Authorities have been too ready to abandon their efforts before the full effect of them has been attained. It is not unnatural that those bodies should desire at the earliest possible date to relieve the trade of their district from irksome restrictions, but it is earnestly to be hoped that before any Local Authority decides upon retrograde action they will take counsel with the officers of the Board, who are at all times anxious to co-operate with them and to advise them as to what steps can with safety be taken, regard being had to the general position of swine-fever throughout the country.

The efficiency of restrictions on the movement of animals depends obviously upon the organisation available to secure their being put into effect. In addition to the work of the police in this direction, the Authorities responsible for the issue of Orders or Regulations of this nature are greatly indebted to the large railway companies, who, through their station-masters and other responsible officials, exercise a constant and invaluable check on the movement of animals by rail. The multiplicity and the variety of the Regulations render this task by no means an easy one, and it redounds to the credit of those concerned that failures to detect irregularities in this respect are so rare.

The Table printed in the Appendix to this Report, page 37, shows the course of the disease in each county in Great Britain in each complete year since the Board's operations began.

Swine-Fever.

The accompanying maps show graphically the distribution of the disease during the past three years.

In order to appreciate fully the improved position at the close of 1902 it is necessary also to compare the outbreaks which occurred in certain counties in the first half of the year with those in the second half of the year.

Thus in the four south-westerly counties of England outbreaks occurred as follows :—

County.	1st Half Year.	2nd Half Year.	Total for 1902.
Cornwall	19	1	20
Devon	24	7	31
Somerset	25	*14	39
Dorset	7	...	7

* Of which only one occurred in the last quarter of the year.

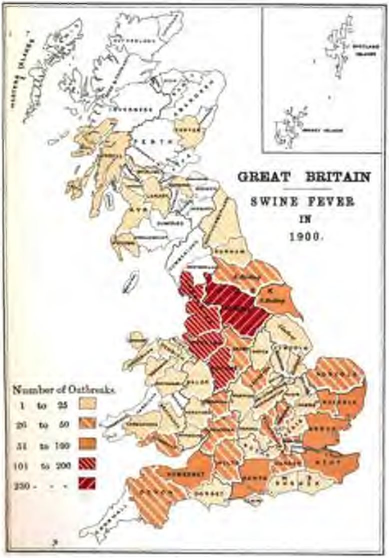
The figures for another group of counties are as follows :—

County.	1st Half Year.	2nd Half Year.	Total for 1902.
Lincoln (Holland) ...	4	4	8
„ (Kesteven) ...	2	...	2
„ (Lindsey) ...	11	2	13
Nottingham	5	4	9
Leicester	1	2	3
Rutland	1	3	4

Good comparative results are also shown in Beds, where out of 18 outbreaks only four occurred in the second half of the year ; the Isle of Wight, where out of 14 none so occurred ; Middlesex, where out of 35 only two so occurred ; and East Sussex, where out of 20 five so occurred.

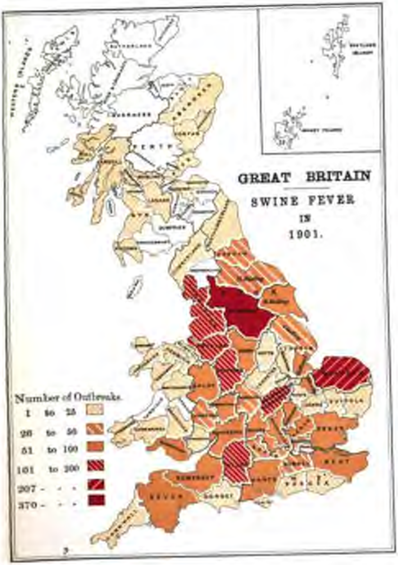
The fact that out of the 181 outbreaks of swine-fever in the West Riding of Yorkshire (pig population 93,852) only five occurred during the last quarter of the year, and all of these prior to October 25th, is also worthy of special record.

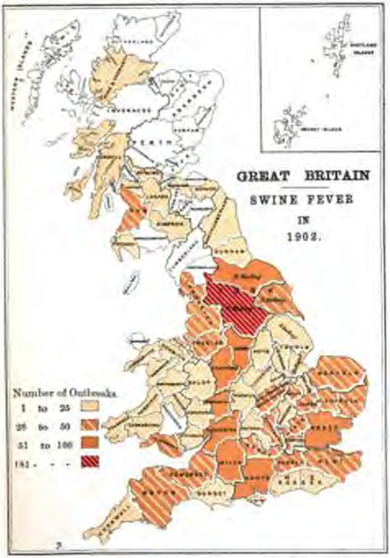
Mainly owing to the above-mentioned Regulations of the Ayrshire Local Authority the disease, which was re-introduced into Ayrshire in July, was practically extinguished by the middle of August. Of the 42 outbreaks confirmed during the year only three cases have occurred since that month.


SHETLAND ISLANDS
ORKNEY ISLANDS
SUTHERLAND
INVERNESS
ABERDEEN
FORFAR
PERTH
AYR
DUMFRIES
DURHAM
LINCOLN
NORFOLK
SUFFOLK
ESSEX
KENT
SUSSEX
HANTS
WILTS
SOMERSET
DORSET
DEVON
CORNWALL
Number of Outbreaks
1 to 25
26 to 50
51 to 100
101 to 200
200 - - -

GREAT BRITAIN

SWINE FEVER
IN
1900.


GREAT BRITAIN
SWINE FEVER
IN
1901.
SHETLAND ISLANDS
ORKNEY ISLANDS
SUTHERLAND
ABERDEEN
FORFAR
PERTH
LANARK
AYR
DUMFRIES
DURHAM
N. RIDING
E. RIDING
NOTTS
SUFFOLK
ESSEX
KENT
SUSSEX
HANTS
SOMERSET
DORSET
DEVON
CORNWALL
Number of Outbreaks.
1 to 25
26 to 50
51 to 100
101 to 200
207 - - -
370 - - -
3



GREAT BRITAIN

SWINE FEVER

IN

1902.

Number of Outbreaks
1 to 25 ▭
26 to 50 ▨
51 to 100 ■
101 - - - ▩
SHETLAND ISLANDS
ORKNEY ISLANDS
WESTERN ISLANDS
SUTHERLAND
INVERNESS
ABERDEEN
FORFAR
PERTH
DURHAM
CUMBERLAND
YORK
LINCOLN
NORFOLK
SUFFOLK
ESSEX
KENT
SUSSEX
WILTS
HANTS
DORSET
SOMERSET
DEVON
CORNWALL

Printed at the Ordnance Survey Office, Southampton, in 1903.

Swine-Fever.

It is difficult to resist the conclusion that swine-fever is a disease that can be successfully combated if all concerned co-operate heartily in carrying out measures on the lines of those that have in the past repeatedly proved successful in extinguishing the disease in smaller areas, and that its re-introduction into a district which has been cleared of it can almost, if not entirely, be prevented by proper precautions which although onerous are not insupportable, and, further, that if promptly discovered and dealt with, in the event of its re-introduction, the disease may speedily be again stamped out.

It is such co-operation that the Board seek, not only from Local Authorities and their officers, but from pigowners and agriculturists generally. It is fully realised that restrictions on movement must be the cause of inconvenience and monetary loss, more especially to those directly engaged in the purchase and sale of swine, but it cannot be too strongly urged that, unless the task is to be entirely abandoned, those losses will be under present conditions recurrent, whereas the successful conclusion of the Board's operations would remove them entirely. Without suggesting that the end is even in view, it may be confidently asserted that at no time has eventual success appeared so likely as at the close of the year 1902.

Sheep-Scab.

Sheep-Scab.

Owing, possibly, to a misconception as to the action taken in the Australian colonies and New Zealand in this connection, the question of the compulsory dipping of all sheep irrespective of the suspicion of the existence of sheep-scab has come prominently to the front during the year under review. An examination of the Colonial Regulations fails to show that any such procedure was adopted by the Colonial Authorities. Compulsory dipping was apparently confined to flocks to which a suspicion of scab attached, and success was evidently in a large measure due to well devised restrictions on the movement of sheep from diseased or suspected flocks.

There can be little question but that Local Authorities in this country have at present powers which, if more widely and systematically exercised, would probably suffice to enable them to prevent effectively the spread of this troublesome disease. The matter was, from this point of view, very fully discussed in a letter addressed to the Central Chamber of Agriculture, the text of which may be here reproduced.

Board of Agriculture,
4, Whitehall Place, S.W.,
31st July, 1902.

SIR,

I am directed by the President of the Board of Agriculture to advert to your letter of the 7th ult., communicating to him the resolution passed by the Council of the Central and Associated Chambers of Agriculture on the 3rd ult. relative to the compulsory dipping of sheep, and also calling attention to a somewhat similar resolution of the Central Chamber passed in February, 1899.

On the question of enforcing by Order the dipping of all sheep, whether affected with, or suspected of, sheep-scab or not, Mr. Hanbury would observe that even if Parliament were to invest the Board with the power of making such

Sheep-Scab.

an Order it could only be exercised by means of a requirement that the process should be carried out throughout the whole of Great Britain on or about certain specified dates. Under any other arrangement flock masters might by moving their animals escape altogether from the obligation. But the varying local methods of sheep-farming pursued and the widely differing conditions of climate affecting (to mention only one instance) the time of shearing render the difficulties attending the selection of such uniform dates almost insuperable.

The practical difficulties attending such a stereotyped system would be especially great on the large hill farms where scab is in fact most prevalent and where the means of enforcing the observance of such regulations are necessarily least effective.

On the other hand, it appears to Mr. Hanbury that there is ample provision in the Sheep-Scab Order of 1898 for keeping the disease of sheep-scab within narrow limits, provided that the powers conferred on Local Authorities by that Order are efficiently exercised and vigorously enforced. The Order empowers and in some cases requires Local Authorities to take measures designed to control the disease, including veterinary inquiry into every reported outbreak, the isolation and the prohibition of the movement of affected or suspected sheep, the treatment of such sheep, and the carrying out of the work of disinfection in default of the owner. In addition, the Order empowers Local Authorities to make regulations governing the movement of sheep into or within the whole or parts of their districts, and such regulations may prescribe that dipping shall be a condition precedent to such movement. By means of such regulations a Local Authority can, if in their opinion the condition of their district as regards the disease justifies such a course, secure what would in effect amount to local compulsory dipping, as their regulations may be so framed as to restrict the movement of undipped sheep into their district, along, over, or across any highway or thoroughfare within the whole or part of their district, and may further require that no sheep be moved into or off any premises within such district unless all of the sheep upon such premises have been dipped within a stated period, and such movement could be controlled by requiring that all sheep to be moved should be accompanied by a licence issued upon such a declaration as to the points in question. In fact, the powers of a Local Authority in this direction are in effect only limited by the provision that such regulations must be adopted with a view to preventing the introduction of sheep-scab into their district or the spreading of sheep-scab within their district.

Where the circumstances of a district in this respect are not such as to induce a Local Authority to resort to such measures, it seems to Mr. Hanbury that the direct enforcement of dipping by the Central Authority would not be justified, and in his opinion the Local Authority are the body best qualified to form a reliable opinion of the needs of a locality in this respect.

It will be seen from the accompanying statement that in the counties of Salop, Lancaster, and the East Riding of Yorkshire very beneficial results have followed the operation of the Order, which, the Board believe, are largely due to the effective character of the regulations of the respective Local Authorities.

There is good reason to believe that if Local Authorities generally were to exercise their powers in an equally effective manner the disease throughout Great Britain would be reduced to such a degree as to enable its ultimate extinction to be effected.

It is observed that the discussions which took place in the Central Chamber on the 6th November, 1900, and the 3rd ult., show that even among the members of the Council of the Chamber itself there is no unanimity of opinion on this subject.

I am, Sir,
Your obedient Servant,
T. H. ELLIOTT,
Secretary.

The Secretary,
Central Chamber of Agriculture,
Broad Sanctuary Chambers,
Westminster, S.W.

Sheep-Scab.

Enclosure in letter of 31st July, 1902.

Statement showing the number of outbreaks of Sheep-Scab and the number of animals attacked in the Counties of Salop, Lancashire, and the East Riding of Yorkshire during the past ten years and for the current year :—

Year.	Salop.		Lancashire.		Yorks., E R.	
	Outbreaks.	Animals attacked.	Outbreaks.	Animals attacked.	Outbreaks.	Animals attacked.
1892 ...	41	737	75	585	36	1,036
1893 ...	29	388	120	779	27	643
1894 ...	23	243	99	457	38	1,267
1895 ...	49	868	114	769	61	1,426
1896 ...	80	350	134	1,092	67	2,262
1897 ...	26	527	84	636	24	554
1898 ...	32	445	94	787	62	1.278
1899 ...	40	437	111	908	28	359
1900 ...	24	218	30	286	28	279
1901 ...	39	246	39	310	13	203
1902* ...	15	107	23	196	4	19

* To end of June, 1902.

Board of Agriculture,
31st July, 1902.

In response, however, to the repeatedly expressed view that the power to compel the dipping of all sheep was one which would be of real value to a Local Authority in combating the disease, Mr. Hanbury has announced his intention of initiating legislation which will enable the Board to confer this power upon Local Authorities.

It may be well to point out here that the dipping of sheep can only in the most limited sense be regarded as a preventive of sheep-scab. If rightly employed the fresh power proposed to be entrusted to Local Authorities may prove a very useful additional weapon in their hands, but much will depend upon the manner in which it is made use of.

As regards the prevalence of sheep-scab, 1,664 outbreaks were reported in Great Britain during the year, a slight increase over the 1,537 reported in 1901. The figure, however, still compares favourably with that of 1900, which was 1,937. In England there has been a noticeable improvement, there having been 691 outbreaks confirmed by the Local Authority in

Sheep-Scab.

38 counties, as against 737 outbreaks in 41 counties in 1901. In Wales the outbreaks increased from 696 to 779, one county less being involved than in 1901; in Scotland from 104 to 194, three more counties being involved.

The accompanying maps show graphically the distribution of the disease during the past three years.

Glanders.

Glanders.

From an administrative point of view there is nothing of special interest to chronicle with regard to glanders. There was a slight decrease in outbreaks as compared with 1901, viz., 1,155 as against 1,347. The disease remains prevalent in the same districts as before, namely, London and the home counties, and the areas round other populous centres such as Liverpool and Glasgow. There was a decrease from 1901 of the number of outbreaks in the county of London of 154 (from 1,009 to 855), which may be regarded as a satisfactory feature.

Anthrax.

Anthrax.

The cases of anthrax showed a slight increase, rising to 678. The method of destroying the carcases by burning, alluded to in the Report of last year, is being more generally adopted, and the results have given satisfaction. The Local Authorities in ten counties have obtained the necessary licences for cremation from the Board. An extension of the practice seems desirable, and will, no doubt, be gradually brought about.

Rabies.

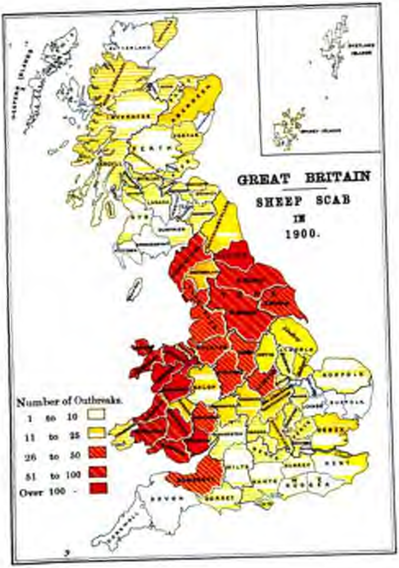
Rabies.

The history of rabies in Great Britain in the year 1902 is, in effect, the history of the course of that disease in the South Western Counties of Wales. It is true that rabies made its appearance in the neighbourhood of Plymouth in the month of April, but the disease in that district did not spread and yielded to the treatment that had been in the past found to be uniformly successful :—namely the muzzling of all dogs in public places over a period sufficiently long to allow of the development of latent disease in animals which might have been in contact with the rabid dog.

Not so in South West Wales, in which district restrictions of a more stringent nature became necessary as the year advanced.

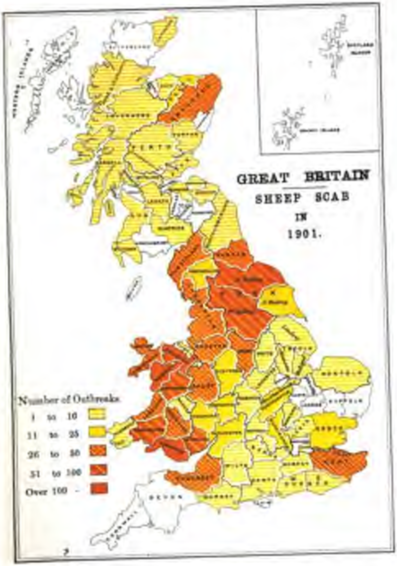
The following is a summary of the cases of rabies which were confirmed in that district :—

1. Crabhall, Marloes, near Milford Haven, Pembrokeshire. (Reported 27th December, 1901.) The rabid animal was a stray dog which, when killed, had the appearance of having travelled a considerable distance. It was found on inquiry to have bitten two children and several dogs and other animals. One of the dogs bitten subsequently developed rabies (*see* No. 6). The history of the dog prior to its appearance in this district could not be ascertained.

# GREAT BRITAIN

SHEEP SCAB IN 1900.

Number of Outbreaks.
1 to 10 ☐
11 to 25 ▨
26 to 50 ▨
51 to 100 ▨
Over 100 ■
SHETLAND ISLANDS
ORKNEY ISLANDS
SUTHERLAND
INVERNESS
ABERDEEN
FORFAR
PERTH
AYR
DUMFRIES
YORK
SALOP
NORFOLK
SUFFOLK
ESSEX
KENT
SUSSEX
SURREY
HANTS
WILTS
DORSET
DEVON
CORNWALL
SOMERSET



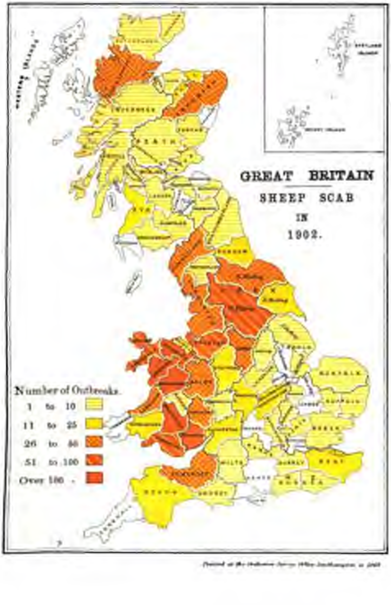
GREAT BRITAIN

SHEEP SCAB

IN

1901.

Number of Outbreaks.
1 to 10
11 to 25
26 to 50
51 to 100
Over 100 -
PERTH
NORFOLK
SUFFOLK
ESSEX
KENT
WILTS
HANTS
SURREY
SUSSEX
DORSET
DEVON
CORNWALL


GREAT BRITAIN
SHEEP SCAB
IN
1902.
Number of Outbreaks.
1 to 10 ▤
11 to 25 🟨
26 to 50 🟧
51 to 100 🟧
Over 100 🟥
SHETLAND ISLANDS
ORKNEY ISLANDS
OUTER HEBRIDES
SUTHERLAND
INVERNESS
ABERDEEN
FORFAR
PERTH
AYR
LANARK
DUMFRIES
KIRKCUDBRIGHT
DURHAM
N. Riding
E. Riding
W. Riding
LINCOLN
NORFOLK
SUFFOLK
ESSEX
KENT
SURREY
SUSSEX
HANTS
WILTS
DORSET
DEVON
CORNWALL

Printed at the Ordnance Survey Office Southampton, in [illegible]

2. Near Haverfordwest, Pembrokeshire. (Reported 16th January.) The rabid dog was a foxhound which had been worked regularly for two months prior to its death, but was missed one day while the pack was at exercise. While astray, it attacked several people in the town of Haverfordwest, one of whom—a boy—was bitten. The source of infection could not be traced.

3. Dolwerdd, near Cardigan, Cardiganshire. (Reported 29th January.) The rabid dog was in this case a foxhound puppy which had been "at walk" for a period of six months on the farm where it was killed. There is some reason for supposing that it may have been bitten by the stray dog referred to under No. 4. The puppy was at large for about two days, during which time it attacked every dog with which it came in contact. One of these—a brother puppy—which is known to have been bitten, was killed shortly afterwards after having shown all the symptoms of rabies. A collie dog had been killed on the same farm, a fortnight before the puppy found to be rabid was destroyed, after showing what had been considered to be symptoms of poisoning.

4. Cilgerran (near Cardigan) Pembrokeshire. (Reported 8th February.) The rabid dog in this case is known to have been bitten five weeks before its death by a stray dog. No definite information concerning the latter could be obtained.

5. Haverfordwest, Pembrokeshire. (Reported 3rd March.) This dog is known to have been bitten about six weeks before its death from rabies by another dog in Haverfordwest Market. No notice of the occurrence was taken at the time, and the latter dog could not be traced.

6. Dale, near Milford Haven, Pembrokeshire. (Reported 21st January.) This dog was bitten about three weeks before its death from rabies by the rabid dog in No. 1.

7. Lower Saltern, near Tenby, Pembrokeshire. (Reported 11th March.) It was ascertained that the rabid dog in this case had been attacked on several occasions by another dog belonging to the same neighbourhood. No suspicion of rabies appears to have attached at the time to the latter, which was destroyed when this case was discovered.

8. Cardigan. (Reported 27th February.) The source of infection in this case could not be traced. The rabid dog went astray the day before it was killed, and inquiry showed that it had in the interval travelled a considerable distance. The owner of the dog was bitten before the dog was destroyed.

9. Dale, near Milford Haven, Pembrokeshire. (Reported 24th March.) The rabid animal was a stray dog. When first observed it had a muzzle hanging round its neck. Its previous history could not be traced.

10. Nevern, near Newport, Pembrokeshire. (Reported 24th April.) The origin of the disease in this case could not be ascertained. The rabid dog was astray for two days prior to its being killed. During this time it travelled some distance in the neighbourhood, and attacked several dogs and persons—a girl being bitten. When destroyed the dog was unmuzzled.

11. Borough of Carmarthen. (Reported 7th May.) The affected dog was a stray. The route taken by it prior to its appearance in Carmarthen was traced for a considerable distance. At the point where it was first noticed it was coming from the direction of Newcastle Emlyn, and possibly came from the district on the borders of Cardigan and Pembroke, where several cases of the disease were discovered during the year. Two persons are known to have been bitten.

12. Near Narberth, Pembrokeshire. (Reported 22nd May.) The rabid animal was a steer. Two bulls and a cow had died six months earlier on an adjoining farm. The cow was certified to have died of anthrax, but it transpired that the post-mortem examination had not been complete, and that the symptoms shown by the cow before death were almost identical with those shown by the affected steer. The steer was in the first instance reported as suffering from anthrax. Shortly before the death of the cattle a dog had been killed on the same farm in an ailing condition, and another dog disappeared mysteriously from the next farm about the same time.

Rabies.

The fact that the disease continued to appear in animals other than dogs, showed conclusively that rabid dogs must have been at large in districts in which their presence had been undetected. The gravity of the situation was enhanced by the fact that on the 28th of May an unfortunate man had died of hydrophobia at Garnant, Carmarthenshire. It transpired that he had been bitten by a dog nearly two years previously in the same neighbourhood. The disease had not been recognised in the dog at the time, but this sad event showed that it had in all probability existed undetected in that district at that date.

After anxious consideration it was determined that in the public interest it was necessary to require that no dog should be moved out of the district scheduled in the South West Wales (Muzzling and Control of Dogs) Order of 1902, and that dogs within that district should be kept under absolute control at night whether on a public or private place, and that during the day the requirement of muzzling should apply at all times except when a dog was effectively secured or, as regards a private place, was kept under control by being led. This Order, which came into force on July 1st, extended to the parts of Glamorgan and Breconshire above referred to. No further case of rabies having occurred the Order was modified on September 25th in respect both of the conditions as to muzzling and control and as to the district to which it applied.

The position at that time appeared very favourable and it was hoped that by the end of the year it would be possible to remove the restrictions altogether. Early in November, however, reports were received from the Llandovery district (which had been exempted from the restrictions by the Order of September 25th) which raised such grave suspicions as to the existence of disease in that part of Carmarthenshire, that it was deemed expedient to impose at once the more stringent restrictions over the Petty Sessional Division of Llandovery and the adjoining parish of Quarter Bach. Inoculative experiments conducted by the Board's Veterinary Officers proved that these suspicions were only too well founded, and all hope of removing the restrictions in force in South West Wales had, for the time being, to be abandoned.

That the action taken in Wales was justified will, it is thought, be admitted by any person who impartially studies the facts as regards rabies in this district set forth in this and in previous Reports. Rabies, which has for some years been practically extinguished in other parts of Great Britain and which had also disappeared from Ireland, had not yielded to the measures which had elsewhere been effective, and, unless the benefits of past proceedings were to be thrown away, there seemed no alternative but to apply more drastic remedies. The restrictions have on the whole been borne with commendable patience, and the Board have, throughout, received invaluable assistance from the Local Authorities and the police. Time alone will show whether success has at last been attained, but without being too sanguine it may be hazarded that the probabilities are that it has.

Rabies.

The amended Regulations as to the importation of dogs from abroad, referred to in the previous Report, had by the close of the year taken full effect. To meet the case of dogowners detained abroad by ill-health the requirement that all imported dogs should be detained on veterinary premises was temporarily modified, such persons being warned that if they took dogs abroad on future occasions no modification of that requirement could again be made. The Regulations have on the whole worked smoothly, and there can be no question but that the security they afford against the re-introduction of rabies exceeds anything that could have been attained so long as the detention of imported dogs on the owner's private premises was permitted. As a matter of fact the more severe restrictions have not diminished the number of dogs under detention, but this is partly due to the close of the War in South Africa, a very considerable number of dogs having been brought home by the troops on their return from the front. The new Regulations as to the isolation of performing dogs have also, on the whole, worked well. So long as the practice prevails of bringing into British ports foreign dogs other than those intended to be landed and to be kept permanently in Great Britain an element of risk will remain. The vigorous enforcement of the provisions of the Order by the Officers of Customs has led to a diminution of this practice, and it is to be hoped that the carrying of dogs on vessels trading with foreign ports may eventually be abandoned.

Casualties in the Cattle-carrying Trade.

(1.) *Foreign Animals.*

Casualties in the Cattle-carrying Trade.

The number of cattle lost at sea during transit to this country was 737, as compared with 1,229 in 1901, and has now reached a proportion of less than 2 per 1,000 of the total shipped.

CATTLE.

Countries from which received.	1902.		1901.		1900.	
	Imported.	Lost.	Imported.	Lost.	Imported.	Lost.
Canada	93,674	216	88,211	229	104,839	834
United States ...	324,431	520	405,704	1,000	350,209	1,072
Argentina	...	...	...	...	38,562	4,096
Uruguay	...	...	...	...	209	1
Channel Islands ...	1,380	1	1,720	. .	1,826	1
TOTAL ...	419,485	737	495,635	1,229	495,645	6,004

Casualties in the Cattle-carrying Trade.

SHEEP.

Countries from which received.	1902.		1901.		1900.	
	Imported.	Lost.	Imported.	Lost.	Imported.	Lost.
Canada	55,033	848	68,030	645	55,673	363
United States ...	233,227	2,547	300,152	3,256	142,906	1,594
Argentina	...	...	...	...	178,069	6,348
Uruguay	...	...	...	...	1,066	32
Ireland	4,943	1	15,432	261	24,217	1,962
TOTAL ...	293,203	3,396	383,594	4,160	382,631	9,069

There was practically no difference in the relative rate of loss among cattle coming from Canada and from the States, but it may be noted that there has been a slight continuous improvement in the Canadian trade wherein the losses were 8 per 1,000 in 1900, and 3 per 1,000 in 1901.

On the other hand, losses among sheep during ocean transit, while relatively the same as in 1901 in the case of the United States, rose from 9 to 15 per 1,000 among those imported from Canada.

The general results may be regarded as satisfactory.

(2.) *Irish Animals.*

The casualties among animals crossing from Ireland to Great Britain—of which fuller returns have been obtained during the past year—are comparatively insignificant in number.

——	Imported.	Lost.	Seriously Injured.
Cattle	959,241	137	372
Sheep	1,005,902	152	36
Swine	637,973	320	267

In all cases where it appeared necessary, enquiry was made by the Board's Inspectors into the causes of any exceptional loss or injury.

Markets and Fairs (Weighing of Cattle) Acts, 1887 *and* 1891.

Markets and Fairs (Weighing of Cattle) Acts, 1887and 1891.

There is nothing of special interest to record with regard to the administration of these Acts during the year under review. Provision has very generally been made for weighing live animals at markets where stock owners desire to avail themselves of the facilities provided.

A. W. ANSTRUTHER.

31st January, 1903.

APPENDIX I.

Swine-Fever.

Number of Outbreaks of Swine-Fever in each County of Great Britain during each Year from 1894 to 1902 inclusive.

SWINE-FEVER.

COUNTY.	OUTBREAKS CONFIRMED.								
	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.
ENGLAND.									
Bedford ...	106	66	67	19	26	19	29	73	18
Berks	47	51	47	31	38	27	35	33	35
Buckingham ...	165	137	88	34	64	60	48	80	99
Cambridge ...	96	14	16	15	7	7	6	14	27
Isle of Ely ...	82	72	45	24	30	14	23	62	11
Chester ...	370	185	172	118	121	120	140	140	39
Cornwall ...	179	136	28	8	4	3	...	12	26
Cumberland ...	...	...	4	6	2	3	...	1	...
Derby	79	96	159	47	47	58	41	63	51
Devon	121	90	96	69	51	29	38	53	31
Dorset	21	23	13	6	22	18	17	18	7
Durham ...	66	122	100	22	33	49	35	46	28
Essex	123	367	304	71	72	90	58	75	79
Gloucester ...	106	129	109	103	106	127	45	71	65
Hants	110	149	104	83	65	44	67	76	87
Isle of Wight	6	4	2	2	3	1	1	19	14
Hereford ...	39	23	9	16	12	26	7	31	7
Hertford ...	34	26	33	11	14	12	19	63	27
Huntingdon ...	176	193	106	36	19	13	12	8	27
Kent	67	115	243	73	69	73	83	64	44
Lancaster ...	173	176	194	100	111	130	121	128	33
Leicester ...	58	68	116	15	29	60	24	19	3
Lincoln, Parts of									
Holland ...	13	9	63	21	35	20	9	77	8
Kesteven ...	9	16	21	7	19	4	6	2	2
Lindsey ...	80	90	73	31	33	23	37	27	13
London ...	13	12	29	7	4	6	...	5	2
Middlesex ...	66	68	106	27	59	48	38	40	35
Monmouth ...	41	56	44	26	16	28	12	23	10
Norfolk ...	121	159	182	46	98	37	39	207	31
Northampton ...	53	195	62	72	61	69	35	123	42
Soke of Peterborough.	29	32	51	7	...	2	1	11	2
Northumberland	5	16	11	5	9	25	5	7	9
Notts	27	43	103	16	29	15	9	25	9
Oxford	62	44	33	15	8	34	8	73	35
Rutland ...	1	1	1	...	...	6	3	1	4
Salop	193	174	81	43	35	91	38	74	35
Somerset ...	596	641	294	72	73	44	97	95	39
Stafford ...	394	390	306	147	169	153	126	138	62
Suffolk ...	44	239	156	59	23	56	57	17	45
Surrey	35	43	37	19	26	25	40	33	45
Sussex, East ...	32	16	2	16	13	22	21	29	20
" West ...	9	7	1	3	8	5	19	7	4
Warwick ...	159	152	189	77	63	32	21	47	25
Westmorland ...	...	...	1	...	...	...	...	...	...
Wilts	256	205	120	42	61	31	42	177	24
Worcester ...	121	138	127	45	67	60	32	54	68
York—									
East Riding...	99	123	109	67	55	75	92	53	34
North Riding	50	140	117	51	57	62	41	46	75
West Riding...	615	658	431	162	188	205	238	370	181
Isles of Scilly ...	...	...	...	...	...	...	...	...	...
TOTAL ...	5,123	5,918	4,721	1,958	2,154	2,041	1,816	2,332	1,545

Swine-Fever.

SWINE-FEVER—*cont.*

COUNTY.	OUTBREAKS CONFIRMED.								
	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.
WALES.									
Anglesey ...	2	3	2	...	...	2	1	2	...
Brecon	6	1	12	3	15	4	7	3	...
Cardigan ...	14	25	3	4	4	2	...	...	1
Carmarthen ...	8	11	9	2	22	7	3	1	2
Carnarvon ...	78	99	16	16	65	19	13	10	8
Denbigh ...	68	68	40	13	19	30	17	24	14
Flint	29	7	9	6	20	16	14	20	6
Glamorgan ...	96	95	141	58	61	75	38	72	34
Merioneth ...	11	2	5	5	2	7	1	1	3
Montgomery ...	34	21	6	10	16	13	6	3	4
Pembroke ...	5	2	1	...	3	...	...	1	2
Radnor ...	...	...	...	...	1	...	...	...	1
TOTAL ...	351	334	244	117	228	175	100	137	75
SCOTLAND.									
Aberdeen ...	11	2	26	2	5	...	...	2	...
Argyll ...	26	15	5	4	6	3	2	9	3
Ayr	7	3	47	8	28	25	2	7	42
Banff	...	...	...	...	...	...	...	...	...
Berwick ...	2	...	...	...	...	...	...	...	2
Bute	...	...	...	2	...	...	...	...	...
Caithness ...	...	...	...	...	...	...	...	...	...
Clackmannan ...	...	...	3	...	1	1	...	...	...
Dumbarton ...	...	3	1	1	...	6	...	1	...
Dumfries ...	2	1	1	2	...	...	...	...	1
Elgin, or Moray	...	3	...	...	...	...	...	...	...
Fife	...	...	8	1	2	...	...	1	...
Forfar	55	46	11	5	8	6	2	3	...
Haddington ...	2	2	1	...	1	...	...	12	...
Inverness ...	...	...	...	...	...	...	...	...	...
Kincardine ...	3	6	2	...	...	...	...	1	...
Kinross ...	...	...	...	...	...	...	...	...	...
Kirkcudbright	10	...	2	5	1	5	...	...	...
Lanark	10	2	8	8	4	18	1	14	5
Linlithgow ...	1	...	3	1	...	1	...	...	...
Midlothian ...	28	21	49	29	23	22	9	4	3
Nairn	...	...	...	...	...	...	...	...	...
Orkney	...	...	...	...	...	...	...	...	...
Peebles ...	...	...	...	1	...	...	...	...	...
Perth	25	9	...	1	12	1	...	...	...
Renfrew ...	...	12	3	2	8	1	3	3	2
Ross and Cromarty.	...	...	...	...	...	...	...	...	1
Roxburgh ...	...	2	...	...	2	...	...	...	...
Selkirk ...	...	...	...	1	...	...	...	...	...
Shetland ...	...	...	...	...	...	...	...	...	...
Stirling ...	4	...	5	2	11	16	1	2	3
Sutherland ...	...	...	...	...	...	...	...	...	...
Wigtown ...	22	23	26	5	20	1	4	12	6
TOTAL ...	208	153	201	80	132	106	24	71	68

Swine-Fever.

SUMMARY.

	Outbreaks Confirmed.								
	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.
ENGLAND ...	5,125	5,818	4,721	1,958	2,154	2,041	1,816	2,302	1,545
WALES ...	351	334	244	117	229	175	100	167	73
SCOTLAND ...	206	153	201	80	132	106	24	71	68
TOTAL ...	5,682	6,305	5,166	2,155	2,514	2,322	1,940	2,540	1,686

APPENDIX II.

Suggested Form of Movement Regulations for Local Authorities under the Swine-Fever Order of 1894 (No. 5193).

(*Name of Local Authority.*)

1. *Swine shall not, except as herein provided, be moved into the district of the above-named Local Authority from the district of any other Local Authority in England or Wales or Scotland.*

2. *Swine may be moved from premises outside the district of the above-named Local Authority to premises in the district if accompanied by a movement licence of an Inspector of the Local Authority authorising such movement.*

3.* *Swine shall not, except as herein provided, be moved along, over, or across a highway or thoroughfare in the district of the above-named Local Authority.*

* Note.—This Regulation will be omitted if movement within the district is not regulated.

4.* *Swine may be moved along, over, or across a highway or thoroughfare in the district of the above-named Local Authority if accompanied by a movement licence of an Inspector of the Local Authority authorising such movement.*

* See Note above.

Swine-Fever

5. *Before a licence is granted by an Inspector under the preceding regulation[s] the owner of the swine, or his agent authorised in writing for this purpose, shall sign and deliver to him a declaration to the effect:—*

   (*a*) *That he is the owner of* [or *the agent authorised in writing for this purpose by the owner of*] *the swine;*

   (*b*) *That the swine have been on the premises from which they are to be moved for a period of at least twenty-eight days immediately before the date of the declaration* [*and that no other pig has been brought on to those premises within such period, whether for breeding purposes or otherwise*]*;*

   (*c*) *That to the best of his knowledge and belief the swine are not affected with swine-fever, and have not during the period of twenty-eight days as aforesaid been in any way exposed to the infection of swine-fever; and*

   (*d*) *That the swine are not in a swine-fever infected place, and that the movement of the swine is not prohibited by notice of an Inspector of a Local Authority or of the Board of Agriculture given under any Order of the Board.*

6. *The Inspector will retain the declaration, and before granting a licence thereon will, so far as is practicable, satisfy himself as to the correctness of the statements contained therein.*

7. *The licence shall be in force for not more than four days, inclusive of the day of issue, and will specify the name and address of the person to whom the licence is granted, the number and description of the swine to be moved, and the name or description of the place from which, and the place and premises to which, the swine are to be moved.*

* *The words in brackets will be omitted unless special provision is made for movement to markets* (see *Regulation 10*).

8. *The movement of swine under the preceding Regulations is subject to the condition that after arrival at the place of destination specified in the licence, if situate in the district of the above named Local Authority, they shall for a period of twenty-eight days be detained at such place of destination* [**but this condition does not apply where the place of destination is a market, fair, sale-yard, or exhibition*].

* See *Note on Regulation 3.*

9.* *Where the declaration required by these Regulations for the granting of a licence states that the swine are to be moved for breeding purposes and for no other purpose, and the licence is marked by the Inspector granting it with the words "For Breeding Purposes," the swine may* *and shall within four days from the date thereof (including the day of issue) be moved by the nearest available route and without unnecessary delay back to the premises from which they were moved under the licence, and shall for a period of twenty-eight days be there detained.*

10. *Where swine are moved with a movement licence to a market, fair, sale-yard, or exhibition in the district of the above-named Local Authority, the swine may only be moved from such premises if accompanied by a movement licence of an Inspector of the Local Authority and to a bacon factory or slaughterhouse situate in the district and specified in the licence, where the swine after their arrival shall be detained until they are slaughtered.*

Where local circumstances permit it is desirable that this Regulation should be omitted.

11. *Swine may be moved from premises outside the district of the above-named Local Authority direct to a bacon factory or slaughterhouse in the district if accompanied by a movement licence of an Inspector of the Local Authority, and subject to the following conditions, namely :—*

No declaration is required for this licence.

   (a) *The swine shall be moved by railway, and without being untrucked within the district, to such railway station as is specified in the licence ;*

   (b) *The swine shall, while being moved from such railway station along, over, or across any highway or thoroughfare to the bacon factory or slaughterhouse specified in the licence, be confined in a van or float ;*

   (c) *The licence shall be in force for not more than four days, inclusive of the day of issue, and shall specify the name and address of the person to whom it is granted, the number of swine that may be moved thereunder, and the name or description of the railway station in the district and of the bacon factory or slaughterhouse to which the swine are to be moved ; and*

   (d) *The swine shall after their arrival at the bacon factory or slaughterhouse be there detained until they are slaughtered.*

12.* *Swine may be moved from any premises in the district of the above-named Local Authority direct to a bacon factory or slaughterhouse in the district if accompanied by a movement licence of an Inspector of the Local Authority and subject to the following conditions, namely :—*

* See *Note on* Regulation 3.

No declaration is required for this licence

   (a) *The swine shall, while being moved along, over, or across any highway or thoroughfare to the bacon factory or slaughterhouse specified in the licence, be confined in a van or float ;*

Swine-Fever

(*b*) *The licence shall be in force for not more than four days, inclusive of the day of issue, and shall specify the name and address of the person to whom it is granted, the number of swine that may be moved thereunder, and the name or description of the bacon factory or slaughter-house to which the swine are to be moved ; and*

(*c*) *The swine shall after their arrival at the bacon factory or slaughterhouse be there detained until they are slaughtered.*

13. *In these Regulations "bacon factory" means premises in which the business of a curer of bacon is carried on, and "slaughterhouse" means any premises where animals are habitually slaughtered.*

14. *Swine, while being moved under a licence, shall so far as practicable be kept separate from all other swine, and shall be moved by the nearest available route and without unnecessary delay to the place of destination specified in the licence, and not elsewhere.*

15. *These Regulations do not authorise movement of swine in a swine-fever infected place or of swine the movement of which is prohibited by notice of an Inspector of a Local Authority or of the Board of Agriculture given under any Order of the Board.*

16. *These Regulations shall not affect the movement of swine to premises in the district of the above-named Local Authority from premises in any of the [boroughs of], if and so long as identical Regulations are for the time being in force in such [borough], [*and provided that the swine are accompanied by a movement licence under such Regulations and are moved to the place of destination specified in the licence].*

* See *Note on Regulation 3.*

17. *For the purposes of these Regulations swine shall not be deemed to be moved into the district of the above-named Local Authority in any case where they are moved through the district by railway from a place outside the district to another place outside the district without unnecessary delay, and without the swine being untrucked or re-booked within the district.*

18. *These Regulations shall come into operation on the day of One thousand nine hundred and*

List of Orders of the Board

wholly or in part in operation* on the 1st January, 1903, under the DISEASES OF ANIMALS ACTS, 1894 and 1896, incorporating the CONTAGIOUS DISEASES (ANIMALS) ACTS, 1878 to 1893.

No.	Date.	Subject or Short Title.
	1884.	
3085	5 February ...	Glasgow—Transhipment.
	1886.	
3480	3 December ...	Hull—Transhipment.
	1893.	
5104	5 June ...	The Cornwall (Parasitic Mange) Order of 1893.
5127	28 July ...	The Warwickshire (Parasitic Mange) Order of 1893.
	1894.	
5152	30 January ...	Glasgow (Yorkhill Wharf, Pointhouse)—Foreign Animals Wharf.
5179	29 May ...	Newcastle-upon-Tyne (St. Lawrence)—Foreign Animals Wharf.
5193	10 July ...	The Swine-Fever Order of 1894.
5218	12 October ...	The Swine-Fever (Movement from Ireland) Temporary Order of 1894.†
5233	29 October ...	The Glanders or Farcy Order of 1894.
	1895.	
5288	22 February ...	The Cattle-Plague Order of 1895.
5289	22 February ...	The Pleuro-Pneumonia Order of 1895.
5290	22 February ...	The Foot-and-Mouth Disease Order of 1895.
5291	22 February ...	The Sheep-Pox Order of 1895.
5305	18 March ...	The Animals (Transit and General) Order of 1895.
5306	18 March ...	The Water Supply on Railways Order of 1895.
5327	15 June ...	The Port of Liverpool Transhipment Order of 1895.
5328	15 June ...	The Port of London Transhipment Order of 1895.

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* For further lists of the Board's Orders, see the Statutory Rules and Orders, 1902, pages 475-8.

† Operation continued by Order No. 6582.

No.	Date.	Subject or Short Title.
	1896.	
5412	27 May ...	The Manchester (Old Trafford) Foreign Animals Wharf Order of 1896.
5414	28 May ...	The Hull (Citadel Estate) Foreign Animals Wharf Order of 1896.
5510	8 December ...	The Foreign Animals Order of 1896.
5511	8 December ...	The Channel Islands Animals Order of 1896.
5512	8 December ...	The Isle of Man Animals Order of 1896.
5513	8 December ...	The Foreign Animals (Quarantine) Order of 1896.
5517	11 December ...	The Southampton (Channel Islands Animals) Landing-Place Order of 1896.
5518	11 December ...	The Markets and Fairs (Swine-Fever) Order of 1896.
	1897.	
5578	23 March ...	The Rabies Order of 1897.
5648	18 June ...	The Birmingham (Swine-Fever) Order of 1897.
5734	31 December ...	The Foreign Animals (Amendment) Order of 1897.
	1898.	
5741	1 February ...	Board may by Licence exempt their Premises and Animals from any Orders.
5797	13 May ...	The Foreign Animals (Amendment) Order of 1898.
5847	13 September	The Sheep-Scab Order of 1898.
5886	25 November...	The Exportation of Horses Order of 1898.
	1899.	
5905	17 January ...	The Anthrax Order of 1899.
6012	13 December ...	The Wandsworth District (Swine-Fever) Order of 1899.
	1900.	
6047	2 April ...	The Foreign Animals (Amendment) Order of 1900.
6115	29 June ...	The Devonshire (Parasitic Mange) Order of 1900.
6116	2 July ...	The Foreign Animals Wharves Order of 1900.
6182	8 November ...	The Liverpool (Birkenhead) Foreign Animals Wharf Order of 1900.
6202	20 December ...	Lancashire, Warrington—Prohibition of markets, &c. of cattle, sheep, or swine in "Eagle and Child" Sale-Yard.
	1901.	
6227	25 March ...	The Foreign Animals (Amendment) Order of 1901.
6257	2 May ...	The Leeds (Swine-Fever) Order of 1901.
6268	6 May ...	Yorkshire (West Riding)—Swine-Fever Infected Area. (Extended by Order No. 6292.)
6275	16 May ...	Yorkshire (West Riding)—Swine-Fever Infected Area. (Extended by Order No. 6292.)

No.	Date.	Subject or Short Title.
	1901—*cont.*	
6292	10 June ...	Yorkshire (West Riding)—Extension of limits of Swine-Fever Infected Areas declared by Orders Nos. 6269 and 6275. (Further extended by Order No. 6309.)
6306	4 July ...	The Foreign Animals (Amendment) Order of 1901 (No. 2).
6309	30 July ...	Yorkshire (West Riding)—Extension of limits of Swine-Fever Infected Area declared by Order No. 6292. (Contracted by Order No. 6370.)
6310	8 August ...	The Deptford Foreign Animals Wharf Order of 1901.
6314	12 August ...	The Cardiff Foreign Animals Wharf Order of 1901.
6333	28 August ...	The Swine-Fever Order of 1901.
6355	14 October ...	The Sheffield (Swine-Fever) Order of 1901.
6396	12 December ...	The Importation of Dogs Order of 1901.
	1902.	
6453	7 May ...	Cornwall, Camborne—Prohibition of Markets of Cattle, Sheep, or Swine.
6472	12 June ...	Staffordshire—Swine-Fever Infected Area.
6488	11 July ...	The Burton-upon-Trent (Swine-Fever) Order of 1902.
6499	28 July ...	Glamorgan—Swine-Fever Infected Area. (Limits extended by Order No. 6514 and contracted by Order No. 6583.)
6514	1 September	Glamorgan—Extension of limits of Swine-Fever Infected Area declared by Order No. 6499.
6516	1 September	The Bristol (Cumberland Basin) Foreign Animals Wharf Order of 1902.
6525	20 September	The South-West Wales (Muzzling and Control of Dogs) Order of 1902 (No. 2).
6526	20 September	The Swine Fever (Infected Areas) Order of 1902.
6551	29 October ...	Yorkshire (West Riding)—Swine-Fever Infected Area. (Limits extended by Order No. 6569.)
6554	3 November...	Huntingdonshire—Swine Fever Infected Area.
6555	4 November...	Worcestershire—Swine-Fever Infected Area.
6556	7 November...	The Bristol (Avonmouth Dock) Foreign Animals Wharf Order of 1902.
6562	14 November...	The Llandovery (Muzzling and Control of Dogs) Order of 1902.
6566	21 November...	Hampshire—Swine-Fever Infected Area.
6567	22 November...	Kent—Swine-Fever Infected Area. (Limits extended by Order No. 6593.)
6569	26 November...	Yorkshire (West Riding)—Extension of limits of Swine-Fever Infected Area declared by Order No. 6551.
6571	28 November..	The Foreign Animals (Amendment) Order of 1902 (No. 2).
6582	11 December ...	The Swine-Fever (Movement from Ireland) Temporary Order of 1902.
6583	15 December ...	Glamorgan—Contraction of limits of Swine-Fever Infected Area extended by Order No. 6514.
6585	15 December ...	The Essex (Swine-Fever) Order of 1902.
6586	15 December ...	The Northamptonshire (Swine-Fever) Order of 1902.
6592	22 December ...	Monmouthshire—Swine-Fever Infected Area.
6593	24 December ...	Kent—Extension of limits of Swine-Fever Infected Area declared by Order No. 6567.

LIST OF PORTS in GREAT BRITAIN where FOREIGN ANIMALS may be Landed. 31st December, 1902.

Port.	Foreign Animals Wharf.
BRISTOL	One at Avonmouth Dock, and one at the Cumberland Basin.
CARDIFF	Bute Docks.
GLASGOW	Yorkhill Wharf, Pointhouse
HULL	Citadel Estate.
LIVERPOOL...	Birkenhead.
LONDON	Foreign Cattle Market, Deptford.
MANCHESTER	Old Trafford.
NEWCASTLE-UPON-TYNE ...	St. Lawrence.

LANDING-PLACE for CHANNEL ISLANDS ANIMALS.

SOUTHAMPTON	Southampton Docks.

STATISTICAL TABLES.

CONTENTS.

Number of Animals in Great Britain.

	Table.	Page.
Cattle, Sheep and Swine, 1898-1902	I.	48
Cattle in each County, 1902	II.	50
Sheep, Swine and Dogs in each County, 1902	III.	52

Number of Animals Imported from Ireland.

	Table.	Page.
Cattle, Sheep and Swine into each British Port, 1902	IV.	54
" " " " from each Irish Port, 1902	V.	56
" " " " into Great Britain, 1893-1902	VI.	58

Number of Animals Imported from Foreign Countries.

	Table.	Page.
Cattle, Sheep and Swine affected with contagious diseases imported in each Year, 1870-1902	VII.	59
Total Cattle, Sheep and Swine from each Country, 1898-1902 ...	VIII.	60
" " " " " into each Port, 1898-1902 ...	IX.	61
" " " " " into each Port from each Country, 1902	X.	62

Disease Among Animals in Great Britain.

	Table.	Page.		Table.	Page.
Cattle-Plague, 1877-1902	XI.	64	Pleuro-Pneumonia, 1870-1890	XIV.	67
Foot-and-Mouth, 1877-1902	XI.	64	Pleuro-Pneumonia, 1890-1902	XV.	67
Sheep-Scab, 1877-1902	XI.	65	Swine-Fever, 1879-1893	XVI.	68
Glanders, 1877-1902	XI.	65	Swine-Fever, 1893-1902	XVII.	68
Anthrax, 1887-1902	XII.	66			
Rabies, 1887-1902	XIII.	66			

Details for Counties, 1902.

	Table.	Page.		Table.	Page.
Swine-Fever	XVIII.	69	Sheep-Scab	XXI.	73
Anthrax	XIX.	70	Foot-and-Mouth ...	XXII.	74
Glanders	XX.	72	Rabies	XXIII.	74

International Trade in Animals.

CATTLE, SHEEP, SWINE imported into or exported from the undermentioned Countries.

	Table.	Page.		Table.	Page.
Argentina	XXIV.	76	Netherlands... ...	XXXII.	84
Austria-Hungary ...	XXV.	77	Norway	XXXIII.	85
Belgium	XXVI.	78	Portugal	XXXIV.	86
Canada	XXVII.	79	Russia	XXXV.	87
Denmark	XXVIII.	80	Spain	XXXVI.	88
France	XXIX.	81	Sweden	XXXVII.	89
Germany	XXX.	82	United States of America	XXXVIII.	90
Italy	XXXI.	83			

TABLE I.—NUMBER of CATTLE, SHEEP, AND SWINE IN GREAT
1900, 1901,

—	YEARS.	CATTLE.				
		Cows and HEIFERS in Milk, or in Calf.	OTHER CATTLE.			TOTAL.
			2 Years old and above.	1 Year old and under 2.	Under 1 Year old.	
ENGLAND ...	1898	1,872,774	1,021,423	892,066	888,040	4,674,303
	1899	1,945,677	1,007,770	931,927	956,478	4,841,852
	1900	1,899,623	1,036,052	990,006	923,017	4,848,698
	1901	1,887,414	1,059,495	944,205	900,421	4,791,535
	1902	1,841,356	988,221	920,253	862,107	4,611,937
WALES	1898	274,073	91,352	159,865	176,487	701,777
	1899	285,794	86,556	169,195	195,146	736,691
	1900	287,014	92,806	185,555	193,011	758,386
	1901	280,899	94,472	179,914	187,793	743,078
	1902	275,880	93,088	174,146	178,760	721,874
SCOTLAND ...	1898	440,343	268,820	293,913	243,208	1,246,284
	1899	439,789	246,984	287,389	243,015	1,217,177
	1900	434,264	243,674	285,247	234,901	1,198,086
	1901	433,981	274,016	283,534	237,750	1,229,281
	1902	438,890	251,053	291,377	240,845	1,222,165
GREAT BRITAIN	1898	2,587,190	1,381,595	1,345,814	1,307,735	6,622,364
	1899	2,671,260	1,341,310	1,388,511	1,394,639	6,795,720
	1900	2,620,901	1,372,532	1,460,808	1,350,929	6,805,170
	1901	2,602,294	1,427,983	1,407,653	1,325,964	6,763,894
	1902	2,556,126	1,332,362	1,385,776	1,281,712	6,555,976

BRITAIN, in the month of June, in each of the Years 1898, 1899, and 1902.

SHEEP			SWINE.	Years.	—
1 Year old, and above.	Under 1 Year old.	Total.	Total.		
9,486,834	6,399,704	15,886,538	2,078,898	1898	England.
9,585,296	6,676,121	16,261,417	2,225,420	1899	
9,465,960	6,378,753	15,844,713	2,021,422	1900	
9,265,889	6,282,168	15,548,057	1,842,133	1901	
8,813,541	6,220,938	15,034,479	1,956,158	1902	
2,100,634	1,168,074	3,268,708	238,581	1898	Wales.
2,187,662	1,228,695	3,416,357	258,154	1899	
2,234,919	1,197,597	3,432,516	228,097	1900	
2,209,771	1,217,963	3,427,734	212,971	1901	
2,209,076	1,253,622	3,462,698	215,283	1902	
4,754,322	2,833,626	7,587,948	134,116	1898	Scotland.
4,728,479	2,832,501	7,560,980	140,239	1899	
4,613,316	2,701,681	7,314,997	132,413	1900	
4,627,066	2,774,343	7,401,409	124,821	1901	
4,500,264	2,768,265	7,268,529	128,126	1902	
16,341,790	10,401,404	26,743,194	2,451,595	1898	GREAT BRITAIN.
16,501,437	10,737,317	27,238,754	2,623,813	1899	
16,314,195	10,278,031	26,592.226	2,381,932	1900	
16,102,726	10,274,474	26,377,200	2,179,925	1901	
15,522,881	10,242,825	25,765,706	2,299,567	1902	

TABLE II.—NUMBER of CATTLE in EACH COUNTY of GREAT BRITAIN,

COUNTIES.	COWS and HEIFERS in Milk, or in Calf.	OTHER CATTLE.			TOTAL.
		2 Years old, and above.	1 Year old, and under 2.	Under 1 Year old.	
TOTAL FOR GREAT BRITAIN.	2,556,120	1,333,362	1,385,776	1,281,718	6,555,976
ENGLAND	1,841,356	988,321	930,263	862,107	4,611,937
WALES	276,880	93,068	174,146	178,780	721,874
SCOTLAND	428,890	261,053	291,377	240,845	1,222,165
ENGLAND					
Bedford	10,898	7,298	6,661	5,343	30,100
Berks	20,270	7,408	7,776	6,638	42,092
Buckingham	29,763	16,326	12,032	10,856	68,977
Cambridge	16,907	12,743	12,455	10,524	52,619
Chester	104,000	12,313	30,370	28,087	174,670
Cornwall..	69,976	43,892	46,821	43,672	204,361
Cumberland	48,100	31,854	32,668	37,307	149,929
Derby	66,881	20,988	24,613	23,520	136,002
Devon	99,375	57,196	63,049	58,429	278,049
Dorset	51,805	10,258	10,756	11,752	84,571
Durham	27,076	16,539	14,861	14,849	73,325
Essex	33,984	16,346	15,810	15,037	81,177
Gloucester	38,228	26,625	29,391	27,166	121,410
Hants	45,484	10,289	11,661	12,578	80,012
Hereford	30,636	16,986	21,173	21,383	90,178
Hertford	14,342	5,583	6,709	5,963	32,597
Huntingdon	7,003	8,256	6,988	4,539	26,786
Kent	31,124	[illegible]	12,453	10,314	66,356
Lancaster	135,070	25,152	34,391	39,401	234,014
Leicester	37,950	52,234	24,539	19,753	134,476
Lincoln	68,030	66,308	55,736	47,880	237,953
London	4,689	124	[illegible]	100	5,001
Middlesex	7,908	2,669	1,965	1,953	14,503
Monmouth	17,562	9,594	9,786	9,953	46,895
Norfolk	35,034	38,108	26,217	23,073	122,432
Northampton	29,490	52,502	20,253	15,717	117,962
Northumberland	28,524	44,380	23,770	19,176	115,872
Notts	26,699	20,856	17,498	14,474	79,527
Oxford	19,420	13,264	13,372	12,245	58,293
Rutland	3,395	7,579	3,751	2,686	17,411
Salop	63,045	33,010	38,964	37,291	172,310
Somerset	104,511	44,996	40,751	38,254	228,512
Stafford	[illegible]	21,934	30,247	29,708	159,036
Suffolk	23,993	12,132	19,646	14,972	70,743
Surrey	20,171	6,551	5,704	5,867	38,293
Sussex	46,803	22,215	18,703	18,007	105,728
Warwick..	34,537	29,482	21,391	19,199	104,609
Westmorland	23,787	10,278	[illegible]	20,049	68,563
Wilts	64,156	13,026	16,743	16,432	110,357
Worcester	25,470	13,525	13,597	12,807	65,399
York, E. Riding	25,196	21,265	19,630	16,825	82,915
„ N. Riding	52,100	41,637	38,034	36,060	167,831
„ W. Riding	122,898	52,143	43,731	41,330	260,102

compiled from the Returns collected on the 4th June, 1902.

COUNTIES (continued.)	COWS and HEIFERS in Milk, or in Calf.	OTHER CATTLE.			TOTAL.
		2 Years old, and above.	1 Year old, and under 2.	Under 1 Year old.	
WALES.					
Anglesey	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Brecon	[illegible]	[illegible]	9,161	[illegible]	[illegible]
Cardigan	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Carmarthen	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Carnarvon	22,401	[illegible]	[illegible]	[illegible]	[illegible]
Denbigh	[illegible]	[illegible]	[illegible]	17,405	[illegible]
Flint	[illegible]	[illegible]	7,708	[illegible]	[illegible]
Glamorgan	[illegible]	[illegible]	10,436	[illegible]	[illegible]
Merioneth	[illegible]	4,727	[illegible]	[illegible]	[illegible]
Montgomery	[illegible]	11,156	[illegible]	[illegible]	[illegible]
Pembroke	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Radnor	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SCOTLAND.					
Aberdeen	45,490	[illegible]	[illegible]	[illegible]	174,748
Argyll	[illegible]	12,017	[illegible]	[illegible]	[illegible]
Ayr	[illegible]	14,310	17,914	19,443	[illegible]
Banff	[illegible]	[illegible]	[illegible]	11,514	[illegible]
Berwick	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Bute	3,740	[illegible]	[illegible]	[illegible]	[illegible]
Caithness	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Clackmannan	1,495	[illegible]	[illegible]	554	[illegible]
Dumbarton	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Dumfries	[illegible]	14,041	[illegible]	[illegible]	[illegible]
Edinburgh	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Elgin or Moray	[illegible]	[illegible]	7,337	5,101	[illegible]
Fife	[illegible]	17,448	[illegible]	[illegible]	[illegible]
Forfar	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Haddington	[illegible]	4,760	[illegible]	[illegible]	[illegible]
Inverness	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Kincardine	[illegible]	6,017	[illegible]	[illegible]	[illegible]
Kinross	[illegible]	1,477	3,067	[illegible]	[illegible]
Kirkcudbright	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Lanark	[illegible]	[illegible]	[illegible]	[illegible]	74,976
Linlithgow	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Nairn	[illegible]	[illegible]	[illegible]	1,560	[illegible]
Orkney	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Peebles	2,104	[illegible]	1,917	[illegible]	[illegible]
Perth	[illegible]	[illegible]	[illegible]	17,325	[illegible]
Renfrew	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Ross and Cromarty	[illegible]	[illegible]	[illegible]	[illegible]	44,134
Roxburgh	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Selkirk	1,175	[illegible]	[illegible]	[illegible]	[illegible]
Shetland	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stirling	[illegible]	8,414	[illegible]	[illegible]	[illegible]
Sutherland	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Wigtown	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE III.—NUMBER of SHEEP and SWINE in EACH COUNTY of GREAT Number of DOGS for which Licences or Certificates of Exemption were furnished by the Board of Inland Revenue.

COUNTIES.	SHEEP.			SWINE.	DOGS.	
	1 Year old, and above.	Under 1 Year old.	TOTAL.	TOTAL.	Licences issued.	Certificates of Exemption granted.
TOTAL FOR GREAT BRITAIN	15,522,881	10,242,825	25,765,706	2,369,567	1,525,273	346,346
ENGLAND	8,813,541	6,220,938	15,034,479	1,956,158	1,351,660	218,018
WALES	2,209,076	1,253,022	3,462,098	215,283	60,786	58,802
SCOTLAND	4,500,264	2,768,265	7,268,529	198,126	112,827	69,526
ENGLAND.						
Bedford	55,062	40,870	95,932	34,034	8,313	1,129
Berks	98,468	64,221	162,689	20,571	14,539	1,961
Buckingham	105,255	80,001	185,256	26,706	12,339	2,228
Cambridge	118,641	72,397	191,038	42,912	9,047	2,741
Chester	54,326	38,718	93,044	67,148	37,998	6,015
Cornwall	219,407	168,149	387,556	85,030	15,140	10,488
Cumberland	363,279	211,904	575,183	18,280	10,748	7,708
Derby	95,312	59,446	154,758	29,207	30,561	6,330
Devon	467,080	336,809	803,889	95,287	30,036	14,120
Dorset	209,813	130,243	340,056	52,049	11,375	2,757
Durham	149,089	100,483	249,572	10,852	45,073	4,966
Essex	149,764	104,456	254,220	73,288	53,719	2,808
Gloucester	199,712	167,343	367,055	67,835	29,826	4,961
Hants	212,347	133,953	346,300	59,908	42,090	3,322
Hereford	185,447	142,957	328,404	24,755	6,866	5,640
Hertford	62,027	36,842	98,869	23,554	17,560	1,392
Huntingdon	46,939	36,287	83,226	16,397	2,836	1,059
Kent	531,512	291,975	823,487	61,794	55,056	4,933
Lancaster	192,063	145,805	337,868	62,465	157,906	13,545
Leicester	182,385	117,190	299,575	22,864	19,480	4,674
Lincoln	612,340	451,536	1,063,876	93,537	34,482	11,367
London	4,173	173	4,346	2,287	153,553	14
Middlesex	12,565	5,803	18,368	11,090	40,433	333
Monmouth	139,052	94,051	233,103	16,201	12,517	4,167
Norfolk	295,602	221,416	517,018	87,312	23,037	5,539
Northampton	225,255	153,063	378,318	36,663	14,732	3,900
Northumberland	602,633	455,092	1,057,725	9,394	21,561	7,545
Notts	106,269	74,036	180,305	26,845	22,194	4,193
Oxford	127,758	99,859	227,617	29,113	10,192	1,900
Rutland	47,079	31,749	78,828	2,108	1,164	728
Salop	259,863	205,440	465,303	67,120	15,338	6,815
Somerset	308,844	182,245	491,089	118,407	21,490	8,794
Stafford	120,240	96,347	216,587	47,861	53,599	4,958
Suffolk	214,749	187,030	401,779	135,817	20,564	4,012
Surrey	40,388	21,840	62,228	10,673	44,634	1,189
Sussex	256,733	151,220	407,953	39,681	35,219	3,004
Warwick	149,136	111,566	260,702	34,152	40,690	3,678
Westmorland	222,030	151,986	374,016	4,500	3,456	4,545
Wilts	271,358	202,680	474,038	55,430	12,910	3,167
Worcester	90,334	72,024	162,358	39,983	23,278	3,356
York, E. Riding	224,167	186,854	411,021	54,560	15,282	4,945
„ N. Riding	408,376	301,632	710,008	61,867	18,151	10,468
„ W. Riding	376,650	283,244	659,894	93,853	112,238	10,450

ITAIN, compiled from the Returns collected on the 4th June, 1902; and sued during the Year ended 31st March, 1902, compiled from a Statement

COUNTIES. (continued.)	SHEEP.			SWINE.	DOGS.	
	1 Year old, and above.	Under 1 Year old.	TOTAL.	TOTAL.	Licences issued.	Certificates of Exemption granted.
WALES.						
Anglesey	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Brecon	[illegible]	[illegible]	[illegible]	7,711	[illegible]	[illegible]
Cardigan	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Carmarthen	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Carnarvon	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Denbigh	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Flint	47,135	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Glamorgan	[illegible]	187,553	[illegible]	[illegible]	[illegible]	[illegible]
Merioneth	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Montgomery	281,111	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Pembroke	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Radnor	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SCOTLAND.						
Aberdeen	[illegible]	[illegible]	[illegible]	[illegible]	(The numbers applicable to the several Counties in Scotland cannot be furnished. (See Total on opposite page.)	
Argyll	[illegible]	[illegible]	[illegible]	4,317		
Ayr	[illegible]	[illegible]	[illegible]	[illegible]		
Banff	[illegible]	25,906	[illegible]	[illegible]		
Berwick	[illegible]	[illegible]	[illegible]	[illegible]		
Bute	[illegible]	[illegible]	[illegible]	[illegible]		
Caithness	[illegible]	[illegible]	[illegible]	[illegible]		
Clackmannan	8,046	[illegible]	[illegible]	[illegible]		
Dumbarton	[illegible]	[illegible]	[illegible]	1,436		
Dumfries..	[illegible]	[illegible]	[illegible]	[illegible]		
Edinburgh	[illegible]	[illegible]	[illegible]	[illegible]		
Elgin, or Moray	[illegible]	[illegible]	[illegible]	[illegible]		
Fife	[illegible]	[illegible]	[illegible]	[illegible]		
Forfar	[illegible]	[illegible]	[illegible]	[illegible]		
Haddington	[illegible]	[illegible]	[illegible]	1,437		
Inverness	391,447	[illegible]	[illegible]	[illegible]		
Kincardine	[illegible]	[illegible]	[illegible]	[illegible]		
Kinross	[illegible]	[illegible]	[illegible]	597		
Kirkcudbright	[illegible]	[illegible]	[illegible]	[illegible]		
Lanark	[illegible]	[illegible]	[illegible]	6,222		
Linlithgow	[illegible]	[illegible]	[illegible]	1,707		
Nairn	13,182	[illegible]	[illegible]	[illegible]		
Orkney	[illegible]	[illegible]	[illegible]	[illegible]		
Peebles	[illegible]	[illegible]	[illegible]	[illegible]		
Perth	[illegible]	[illegible]	[illegible]	[illegible]		
Renfrew	[illegible]	[illegible]	[illegible]	[illegible]		
Ross and Cromarty	[illegible]	[illegible]	[illegible]	[illegible]		
Roxburgh	[illegible]	[illegible]	[illegible]	[illegible]		
Selkirk	[illegible]	[illegible]	[illegible]	[illegible]		
Shetland	[illegible]	[illegible]	[illegible]	[illegible]		
Stirling	76,376	[illegible]	[illegible]	[illegible]		
Sutherland	[illegible]	[illegible]	[illegible]	[illegible]		
Wigtown	[illegible]	[illegible]	[illegible]	[illegible]		

TABLE IV.—NUMBER of CATTLE, SHEEP, and SWINE IMPORTED
GREAT BRITAIN to which

(Furnished by the Department of Agriculture

PORTS in GREAT BRITAIN.	CATTLE.					
	Oxen, Bulls, and Cows.				Calves.	TOTAL.
	Fat.	Store (*for fattening or breeding purposes*).	Others.	Total.		
Ardrossan ...	5,214	26,315	[illegible]	31,717	47	31,764
Ayr	5,457	32,479	87	38,023	410	38,433
Barrow-in-Furness	3,506	22,468	2	25,976	103	26,079
Bristol	8,074	35,599	6	43,679	13,680	57,359
Dover	16	53	...	69	101	170
Fleetwood ...	4,350	15,955	...	20,305	334	20,639
Glasgow	31,742	98,747	8,004	138,493	24,663	163,156
Greenock	1,429	9,621	69	11,119	48	11,167
Holyhead	47,937	83,014	74	131,025	1,607	132,632
Liverpool	147,527	122,481	2,101	272,109	10,339	282,448
London	...	[illegible]	...	3	...	3
Manchester ...	20,421	5,738	...	26,159	1	26,160
Milford	11,639	30,456	75	42,170	29,165	71,335
Morecambe ...	4,740	29,235	...	33,975	130	34,105
Newhaven ...	...	180	...	[illegible]	104	284
Newport	21	5	...	26	...	26
Plymouth... ...	1,762	1,000	14	2,776	2,831	5,607
Silloth	8,805	6,663	...	15,468	...	15,468
Southampton ...	2,139	775	14	2,928	1,597	4,525
Stranraer ...	2,032	28,694	...	30,726	1	30,727
Whitehaven ...	81	7,073	...	7,154	...	7,154
TOTAL ...	306,892	556,554	10,634	874,080	85,161	959,241

FROM IRELAND during the Year 1902, showing the PORTS IN
such animals were shipped.
and Technical Instruction for Ireland.)

Sheep.			Swine.			Ports in Great Britain.
Sheep.	Lambs.	Total.	Fat.	Store.	Total.	
309	2,844	3,153	2,359	8,628	10,987	Ardrossan.
1,392	1,996	3,388	1,185	10,066	11,251	Ayr.
64	492	556	14,932	2	14,934	Barrow-in-Furness.
30,626	16,727	47,353	50,622	1	50,623	Bristol.
162	...	162	...	...	...	Dover.
3,702	7,641	11,343	6,214	263	6,477	Fleetwood.
7,729	9,076	16,805	39,620	2,558	42,178	Glasgow.
665	1,041	1,706	685	1,811	2,496	Greenock.
134,973	53,031	188,004	196,101	1,595	197,696	Holyhead.
314,906	281,608	596,514	200,445	4,522	204,967	Liverpool.
...	...	...	...	...	...	London.
35,388	23,348	58,736	4,114	4	4,118	Manchester.
55,874	51,001	106,875	46,766	3	46,769	Milford.
8,413	5,662	14,075	34,188	225	34,413	Morecambe.
635	21	656	...	...	...	Newhaven.
54	...	54	51	...	51	Newport.
498	130	628	178	...	178	Plymouth.
1,294	591	1,885	539	...	539	Silloth.
2,188	463	2,651	3,270	...	3,270	Southampton.
395	760	1,155	155	5,148	5,303	Stranraer.
52	51	103	1,684	38	1,722	Whitehaven.
599,319	456,483	1,055,802	603,108	34,864	637,972	TOTAL.

TABLE V.—NUMBER of CATTLE, SHEEP, and SWINE IMPORTED
PORTS IN IRELAND from

(Furnished by the Department of Agriculture

PORTS in IRELAND.	CATTLE.					
	Oxen, Bulls, and Cows.				Calves.	TOTAL.
	Fat.	Store (*for fattening or breeding purposes*).	Others.	Total.		
Ballina	892	12	637	1,541	...	1,541
Belfast	23,063	121,971	569	145,603	861	146,464
Coleraine	139	3,057	379	3,575	14	3,589
Cork	7,438	49,278	3,262	59,978	54,802	114,780
Drogheda... ...	33,068	8,785	...	41,853	45	41,898
Dublin	179,755	161,699	2,467	343,921	13,030	356,951
Dundalk	8,774	28,205	...	36,979	...	36,979
Dundrum... ...	30	476	...	506	...	506
Greenore	392	27,130	...	27,522	79	27,601
Larne	2,107	33,035	...	35,142	1	35,143
Limerick	2,743	2,369	12	5,124	1	5,125
Londonderry ...	14,634	56,325	2,156	73,115	14,278	87,393
Newry	1,305	7,357	...	8,662	[illegible]	8,665
Portrush	96	351	25	472	...	472
Rosslare	271	...	...	271	...	271
Sligo	135	6,303	[illegible]	6,573	...	6,573
Waterford ...	25,108	47,045	368	72,521	2,042	74,563
Westport	849	27	618	1,494	...	1,494
Wexford	6,093	3,129	6	9,228	5	9,233
TOTAL ...	306,892	556,554	10,634	874,080	85,161	959,241

into GREAT BRITAIN from IRELAND, during the Year 1902, showing the
which such animals were sent.

and Technical Instruction for Ireland.)

SHEEP.			SWINE.			PORTS in IRELAND.
Sheep.	Lambs.	TOTAL.	Fat.	Store.	TOTAL.	
8,786	5,826	14,612	5,471	...	5,471	Ballina.
8,644	28,501	37,145	30,500	19,781	50,281	Belfast.
2,580	148	2,728	223	147	370	Coleraine.
52,057	55,582	107,639	63,951	86	64,037	Cork.
51,920	53,047	104,967	15,548	1,565	17,113	Drogheda.
326,979	204,211	531,190	305,835	622	306,457	Dublin.
12,218	13,668	25,886	24,654	2,551	27,205	Dundalk.
52	19	71	—	—	—	Dundrum.
21,055	1,251	22,306	5,230	1,371	6,601	Greenore.
1,413	1,280	2,693	351	5,349	5,700	Larne.
633	410	1,043	6	...	6	Limerick.
22,344	17,456	39,800	8,378	3,285	11,663	Londonderry.
3,792	6,028	9,820	2,927	...	2,927	Newry.
109	69	178	1,967	87	2,054	Portrush.
267	...	267	1,214	...	1,214	Rosslare.
7,556	9,897	17,453	42,007	...	42,007	Sligo.
47,924	36,392	84,316	61,612	5	61,617	Waterford.
12,482	13,170	25,652	8,362	15	8,377	Westport.
24,518	6,518	31,036	24,872	...	24,872	Wexford.
599,319	456,483	1,055,802	603,108	34,864	637,972	TOTAL.

TABLE VI.—NUMBER of CATTLE, SHEEP, and SWINE IMPORTED into GREAT BRITAIN from IRELAND, during each of the Years 1898, 1899, 1900, 1901, and 1902.

YEARS.	CATTLE.					
	OXEN, BULLS, and COWS.				CALVES.	TOTAL.
	Fat.	Store (*for fattening or breeding purposes*).	Others.	TOTAL.		
	No.	*No.*	*No.*	*No.*	*No.*	*No.*
1898	278,770	460,903	4,101	743,774	59,588	803,362
1899	278,064	442,921	6,219	727,204	45,068	772,272
1900	275,450	427,891	7,442	710,783	34,736	745,519
1901	261,690	344,954	6,269	612,913	29,725	642,638
1902	306,892	556,554	10,634	874,080	85,161	959,241

YEARS.	SHEEP.			SWINE.		
	SHEEP.	LAMBS.	TOTAL.	FAT.	STORE.	TOTAL.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*
1898	449,558	383,900	833,458	556,723	32,062	588,785
1899	452,070	419,883	871,953	650,850	37,703	688,553
1900	478,081	384,182	862,263	673,847	41,355	715,202
1901	484,516	358,809	843,325	559,232	36,897	596,129
1902	599,319	456,483	1,055,802	603,108	34,864	637,972

TABLE VII.—NUMBER of FOREIGN CATTLE, SHEEP, and SWINE affected with any CONTAGIOUS DISEASE, which were Imported into GREAT BRITAIN, in each Year, from 1870 to 1902 inclusive.

YEARS.	CATTLE-PLAGUE.	PLEURO-PNEUMONIA.	FOOT-AND-MOUTH DISEASE.			SHEEP-POX.	SHEEP-SCAB.	SWINE-FEVER. *
	CATTLE.	CATTLE.	CATTLE.	SHEEP.	SWINE.	SHEEP.	SHEEP.	SWINE.
1870	...	1	302	132	882	1	303	...
1871	...	6	581	66	252	1	2,897	...
1872	8	19	3,730	2,136	229	...	655	...
1873	...	5	237	54	91	...	437	...
1874	...	2	1,725	44	734	...	119	...
1875	...	16	8,433	7,355	4,221	1	304	...
1876	...	11	6,734	3,213	1,391	30	2,262	...
1877	39	12	639	1,567	110	...	1,423	...
1878	...	...	18	676	58	...	941	...
1879	...	147	1	77	64	...	697	1,044
1880	...	231	70	70	15	3	438	616
1881	...	39	6,109	841	27	1	665	157
1882	...	5	504	87	4	...	210	49
1883	...	4	761	279	232	...	833	12
1884	...	6	131	7	...	...	271	6
1885	...	7	...	3	...	...	16	1
1886	...	6	...	—	...	...	—	2
1887	...	22	...	...	...	...	...	1
1888	...	21	...	13	...	...	...	62
1889	...	47	...	104	...	...	90	8
1890	...	14	...	...	...	...	2,553	64
1891	...	8	...	...	...	...	5,824	—
1892	...	23	...	...	...	...	1,708	66
1893	...	40	...	...	...	...	5,774	...
1894	...	11	...	...	...	...	15,975	...
1895	...	26	...	...	...	...	43,113	...
1896	...	...	...	...	...	...	7,666	—
1897	...	...	...	...	...	...	5,905	...
1898	...	...	...	...	...	...	9,768	25
1899	...	...	...	...	...	...	3,273	...
1900	...	...	1,553	4,014	...	...	3,531	...
1901	...	...	...	...	...	...	135	—
1902	...	...	...	...	...	...	160	...

* Swine-Fever (or Typhoid Fever of Swine) was not declared to be a contagious disease prior to the 9th December 1878, but by an Order which came into operation on that date, it was declared to be a contagious disease for the purposes of the Diseases of Animals Acts.

TABLE VIII.—NUMBER of FOREIGN CATTLE, SHEEP, and SWINE IMPORTED into GREAT BRITAIN, during each of the Years 1898 to 1902 inclusive, distinguishing the COUNTRIES from which such Imports were received.

COUNTRIES from which received.	YEARS.	CATTLE.	SHEEP.	SWINE.
CHANNEL ISLANDS...	1898	1,814	...	...
	1899	1,732	...	...
	1900	1,826	...	...
	1901	1,720	...	...
	1902	1,380	...	...
ICELAND	1898	...	28,086	...
	1899	...	22,650	...
	1900	...	24,217	...
	1901	...	15,432	...
	1902	...	4,943	...
ARGENTINA*	1898	89,369	430,073	...
	1899	85,365	382,080	...
	1900*	38,562	178,969	...
	1901	...	...	...
	1902	...	...	...
CANADA	1898	108,405	42,070	...
	1899	94,660	63,930	...
	1900	104,839	35,673	...
	1901	88,211	68,010	...
	1902	93,674	55,033	...
UNITED STATES of AMERICA ...	1898	369,478	147,021	†450
	1899	321,229	121,030	...
	1900	350,209	142,906	...
	1901	405,704	300,152	...
	1902	324,431	233,227	...
OTHER COUNTRIES...	1898	...	‡16,497	...
	1899	§518	‖ 18,065	...
	1900	209	1,068	...
	1901	...	...	...
	1902	...	...	...
TOTAL	1898	569,066	663,747	450
	1899	503,504	607,755	...
	1900	495,645	382,833	...
	1901	495,635	383,594	...
	1902	419,485	293,203	...

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* Importation from Argentina was prohibited by Order, dated 2nd April, 1900.

† Since 2nd June, 1898, the importation of swine from the United States of America has been prohibited.

‡ Of this number, 12,193 were imported from the Falkland Islands.

§ These cattle were imported from Uruguay.

‖ This number consisted of 13,602 sheep imported from Chile, and 4,462 imported from Uruguay

TABLE IX.—NUMBER of FOREIGN CATTLE, SHEEP, and SWINE IMPORTED into the undermentioned PORTS in GREAT BRITAIN, during each of the Years 1898 to 1902 inclusive.

PORTS.	YEARS.	CATTLE.	SHEEP.	SWINE.
BRISTOL	1898	18,631	1,326	...
	1899	16,598	8,271	...
	1900	14,394	3,034	...
	1901	15,337	6,192	...
	1902	9,823	6,885	...
CARDIFF	1898	451	...	...
	1899	2,324	1,237	...
	1900	3,387	596	...
	1901	2,861	767	...
	1902	...	...	...
GLASGOW	1898	51,867	23,022	...
	1899	44,961	22,526	...
	1900	54,130	17,974	...
	1901	50,902	37,953	...
	1902	28,655	12,454	...
HULL	1898	8,250	1,748	...
	1899	9,140	...	...
	1900	8,315	...	...
	1901	6,893	5,855	...
	1902	2,520	1,985	...
LIVERPOOL	1898	255,281	281,788	...
	1899	268,058	274,376	...
	1900	224,661	193,865	...
	1901	243,859	249,789	...
	1902	224,069	195,633	...
LONDON	1898	222,853	353,303	450
	1899	168,069	297,200	...
	1900	170,752	159,786	...
	1901	153,385	69,149	...
	1902	137,369	71,258	...
MANCHESTER	1898	6,323	2,662	...
	1899	8,759	4,945	...
	1900	15,090	5,270	...
	1901	14,963	13,898	...
	1902	14,441	5,016	...
NEWCASTLE-UPON-TYNE	1898	3,607	...	...
	1899	2,863	...	...
	1900	2,090	268	...
	1901	2,902	...	...
	1902	1,218	...	...
SOUTHAMPTON	1898	1,854	...	...
	1899	1,732	...	...
	1900	1,826	...	...
	1901	1,720	...	...
	1902	1,380	...	...

TABLE X.—RETURN of the Number of FOREIGN CATTLE and SHEEP received, and the PORTS at which

COUNTRIES from which received.	BRISTOL.		GLASGOW.	
	Cattle.	Sheep.	Cattle.	Sheep.
CANADA	6,997	2,943	17,265	6,432
UNITED STATES of AMERICA* ...	2,826	3,942	11,290	6,022
ICELAND	...	...	...	...
CHANNEL ISLANDS	...	...	...	...
TOTAL	9,823	6,885	28,555	12,454

COUNTRIES from which received.	MANCHESTER.		NEWCASTLE-UPON-TYNE.	
	Cattle.	Sheep.	Cattle.	Sheep.
CANADA	11,764	5,016	628	...
UNITED STATES of AMERICA* ...	2,677	...	590	...
ICELAND	...	...	...	...
CHANNEL ISLANDS	...	...	...	...
TOTAL	14,441	5,016	1,218	...

* The Inspector in Great Britain of the United States of America Department of Agriculture states cattle and [illegible] sheep landed at London, and [illegible] cattle landed at Manchester from the United States.

to each Port in Great Britain,—1902.

IMPORTED into GREAT BRITAIN, showing the COUNTRIES from which landed, during the Year 1902.

HULL.		LIVERPOOL.		LONDON.		COUNTRIES from which received.
Cattle.	Sheep.	Cattle.	Sheep.	Cattle.	Sheep.	
...	...	31,321	10,117	25,609	30,525	CANADA.
2,530	1,955	192,748	180,575	111,780	40,733	UNITED STATES of AMERICA.*
...	...	...	4,943	...	...	ICELAND.
...	...	...	...	...	...	CHANNEL ISLANDS.
2,530	1,955	224,069	195,635	137,389	71,258	TOTAL.

SOUTHAMPTON.		TOTAL.		COUNTRIES from which received.
Cattle.	Sheep.	Cattle.	Sheep.	
...	...	95,474	53,083	CANADA.
...	...	324,451	235,227	UNITED STATES of AMERICA.*
...	...	...	4,943	ICELAND.
1,380	...	1,380	...	CHANNEL ISLANDS.
1,380	...	419,485	293,253	TOTAL.

[illegible] 6,867 cattle and 1,398 sheep landed at Glasgow, 61,312 cattle and 38,240 sheep landed at Liverpool, [illegible] were Canadian.

TABLE XI.—Number of COUNTIES in GREAT BRITAIN in which the LOCAL AUTHORITIES, with the Number of OUTBREAKS reported, each Disease, in each Year,

YEARS.	CATTLE-PLAGUE.			FOOT-AND-MOUTH DISEASE.					
	Counties.	Outbreaks.	Cattle Attacked.	Counties.	Outbreaks.	Animals Attacked.			
						Cattle.	Sheep.	Swine.	Other Animals.
1877	5	47	263	55	858	5,640	7,405	2,099	...
1878	...	...	...	45	235	912	8,609	245	...
1879	...	...	...	29	187	261	15,681	5	...
1880	...	...	...	38	1,461	20,918	9,572	1,886	2
1881	...	...	...	49	4,833	59,484	117,152	6,330	80
1882	...	...	...	49	1,970	23,973	11,412	2,564	1
1883	...	...	...	75	18,732	219,289	217,492	24,332	32
1884	...	...	...	55	949	12,186	14,174	1,860	1
1885	...	...	...	10	30	354	54	30	...
1886	...	...	...	1	1	10	...	...	...
1887	...	...	...	...	...	...	...	...	...
1888	...	...	...	...	...	...	...	...	...
1889	...	...	...	...	...	...	...	...	...
1890	...	...	...	...	...	...	...	...	...
1891	...	...	...	...	...	...	...	...	...
1892	...	...	...	15	95	1,248	3,412	107	...
1893	...	...	...	2	2	30	...	...	...
1894	...	...	...	3	3	7	261	...	...
1895	...	..	...	...	...	...	...	...	...
1896	...	...	...	...	...	...	...	...	...
1897	...	...	...	...	...	...	...	...	...
1898	...	...	...	...	...	...	...	...	...
1899	...	...	...	...	...	...	...	...	...
1900	...	...	...	9	21	214	50	2	...
1901	...	...	...	3	12	43	626	...	...
1902	...	...	...	1	1	2	118	...	...

UNDERMENTIONED DISEASES were reported by the INSPECTORS OF THE
and the Number of ANIMALS returned as ATTACKED by
from 1877 to 1902 inclusive.

YEARS.	SHEEP-SCAB.			GLANDERS (INCLUDING FARCY).		
	Counties.	Outbreaks.	Sheep Attacked.	Counties.	Outbreaks.	Horses Attacked.
1877	77	3,214	69,715	40	518	758
1878	75	2,331	53,049	45	585	888
1879	63	2,239	54,007	52	956	1,367
1880	70	1,556	26,173	37	1,439	2,110
1881	77	2,055	32,571	35	1,012	1,720
1882	78	2,294	38,509	33	850	1,389
1883	73	1,898	34,571	35	753	1,244
1884	73	1,509	28,447	34	713	1,123
1885	65	1,512	23,718	30	637	966
1886	74	1,502	23,676	27	776	1,114
1887	73	1,596	26,383	35	1,003	1,482
1888	72	1,260	18,762	30	1,007	1,581
1889	73	1,297	22,023	25	1,262	2,246
1890	73	1,806	35,369	24	958	1,808
1891	80	2,350	44,637	28	1,551	2,438
1892	82	2,621	53,314	34	1,657	3,001
1893	86	2,603	45,398	40	1,361	2,153
1894	84	2,521	62,802	33	965	1,437
1895	88	3,092	48,663	36	964	1,534
1896	79	3,536	66,666	31	817	1,294
1897	80	2,791	33,346	31	900	1,629
1898	79	2,514	38,543	30	749	1,385
1899	79	2,056	33,290	35	653	1,472
1900	78	1,939	26,450	29	1,119	1,808
1901	74	1,587	22,764	43	1,367	2,239
1902	73	1,664	21,585	33	1,155	2,049

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TABLE XII.—NUMBER of COUNTIES in GREAT BRITAIN in which ANTHRAX was reported by the INSPECTORS OF THE LOCAL AUTHORITIES, with the Number of OUTBREAKS reported, and the Number of EACH KIND OF ANIMAL returned as ATTACKED, in each Year, from the first complete Year since the passing of the Anthrax Order of 1886 to the Year 1902 inclusive.

YEARS.	COUNTIES.	OUT-BREAKS Reported.	ANIMALS ATTACKED.				
			Cattle.	Sheep.	Swine.	Horses.	Deer.
1887	51	236	415	37	194	*	..
1888	49	180	280	45	76	*	..
1889	45	167	236	4	69	*	461
1890	48	152	253	72	210	*	..
1891	50	236	300	15	156	*	..
1892	60	249	445	11	190	*	..
1893	68	563	833	108	313	46	..
1894	64	494	625	125	188	62	..
1895	66	434	604	158	140	33	..
1896	64	485	632	34	200	38	..
1897	67	433	521	39	284	38	..
1898	73	556	634	22	161	30	..
1899	67	534	634	60	253	30	..
1900	71	671	868	40	204	44	..
1901	63	651	708	76	182	35	..
1902	71	678	746	50	192	44	..

* Prior to the Year 1893, Horses, Asses, and Mules were not included in the definition of the word "Animals" in the Orders relating to Anthrax.

TABLE XIII.—NUMBER of COUNTIES in GREAT BRITAIN in which Cases of RABIES in DOGS were reported in each Year, from the first complete Year since the passing of the Rabies Order of 1886 to the Year 1902 inclusive.

YEARS.	COUNTIES.	CASES.	YEARS (continued).	COUNTIES.	CASES.
1887	28	217	1895	29	672
1888	19	160	1896	41	438
1889	20	312	1897	30	151
1890	20	129	1898	10	17
1891	17	79	1899	4	9
1892	12	38	1900	2	6
1893	18	93	1901	1	1
1894	17	248	1902	4	13

TABLE XIV.—NUMBER of COUNTIES in GREAT BRITAIN in which PLEURO-PNEUMONIA was reported by the INSPECTORS OF THE LOCAL AUTHORITIES, with the Number of OUTBREAKS reported, and the Number of CATTLE returned as ATTACKED, in each Year from 1870 to the 1st September 1890, when the Board of Agriculture assumed powers with respect to Pleuro-Pneumonia under the Diseases of Animals Acts.

YEARS.	Counties.	Outbreaks Reported.	Cattle Attacked.	YEARS (*continued*).	Counties.	Outbreaks Reported.	Cattle Attacked.
1870	68	1,508	4,002	1881	45	729	1,875
1871	68	1,660	5,809	1882	46	494	1,200
1872	71	2,474	7,983	1883	40	349	[illegible]
1873	72	2,711	6,787	1884	33	312	1,006
1874	71	3,262	7,740	1885	41	404	1,511
1875	71	2,492	5,806	1886	48	553	2,471
1876	66	2,178	5,253	1887	47	618	2,437
1877	70	2,007	5,330	1888	39	513	1,843
1878	67	1,721	4,593	1889	41	474	1,846
1879	63	1,549	4,414	1890 (8 Months) *	* 38	* 346	* 1,466
1880	51	1,052	2,765				

* The figures quoted for Pleuro-Pneumonia for 1890 are for the first Eight Months only. For the figures relating to the last Four Months of that year, and to each subsequent Year, see Table XV.

TABLE XV.—NUMBER of COUNTIES in GREAT BRITAIN in which PLEURO-PNEUMONIA existed, Number of OUTBREAKS Confirmed, and particulars relating thereto, in each Year from the 1st September 1890, when the Board of Agriculture assumed powers with respect to Pleuro-Pneumonia under the Diseases of Animals Acts, to the Year 1902 inclusive.

YEARS.	COUNTIES.	OUTBREAKS Confirmed.	CATTLE found DISEASED.	CATTLE SLAUGHTERED as having been Exposed to Infection.
1890 (4 months) †	† 20	† 119	† ‡ 591	† 5,380
1891	27	102	778	9,491
1892	10	35	134	3,477
1893	4	9	80	1,157
1894	2	2	15	391
1895	1	1	§ 1	43
1896	1	2	¶ 9	183
1897	5	7	48	741
1898	1	1	1	230
1899	..	..	..	..
1900	..	..	..	..
1901	..	..	..	.
1902	..	..	..	..

† The figures quoted for Pleuro-Pneumonia for 1890 are for the last Four Months only. For the figures relating to the first Eight Months of that year, and to previous years, see Table XIV.

‡ Including 20 cattle which were killed by order of the owners, and 18 which died.

§ Pleuro-Pneumonia was detected in the carcase of this animal, after slaughter by order of the owner.

¶ Including one head of cattle which was killed by order of the owner, and 2 cattle which died.

TABLE XVI.—NUMBER of COUNTIES in GREAT BRITAIN in which SWINE-FEVER was reported by the INSPECTORS OF THE LOCAL AUTHORITIES, with the Number of OUTBREAKS reported, and the Number of SWINE returned as ATTACKED, in each Year from 1879 to the 1st November 1893, when the Board of Agriculture assumed powers with respect to Swine-Fever under the Diseases of Animals Acts.

YEARS.	Counties.	Outbreaks Reported.	Swine Attacked.	YEARS (*continued*).	Counties.	Outbreaks Reported.	Swine Attacked.
1879	53	2,705	17,074	1887	71	7,298	41,973
1880	50	1,036	9,865	1888	69	6,449	32,341
1881	56	1,717	7,994	1889	61	4,841	25,995
1882	56	2,083	14,763	1890	64	5,078	29,002
1883	53	2,400	11,225	1891	66	5,595	32,349
1884	54	1,877	8,939	1892	68	2,748	13,957
1885	70	7,926	38,796	1893 (10 Months) *	* 65	* 2,377	* 11,729
1886	63	6,813	35,029				

* The figures quoted for Swine-Fever for 1893 are for the first Ten Months only. For the figures relating to the last Two Months of that year, and to each subsequent Year, see Table XVII.

TABLE XVII.—NUMBER of COUNTIES in GREAT BRITAIN in which SWINE-FEVER existed, Number of OUTBREAKS Confirmed, and Number of SWINE SLAUGHTERED, by order of the Board of Agriculture, as Diseased or Exposed to Infection, in each Year from the 1st November 1893, when the Board assumed powers with respect to Swine-Fever under the Diseases of Animals Acts, to the Year 1902 inclusive.

YEARS.	COUNTIES.	OUTBREAKS Confirmed.	SWINE SLAUGHTERED as Diseased, or as having been Exposed to Infection.
1893 (2 Months) †	† 47	† 536	† 6,045
1894	73	5,682	56,296
1895	78	6,305	69,931
1896	77	7,166	79,586
1897	74	2,155	40,432
1898	72	2,514	43,756
1899	71	2,322	30,707
1900	62	1,946	17,933
1901	71	3,146	15,237
1902	67	[illegible]	8,363

† The figures quoted for Swine-Fever for 1893 are for the last Two Months only. For the figures relating to the first Ten Months of that year, and to previous Years, see Table XVI.

TABLE XVIII.—NUMBER of OUTBREAKS of SWINE-FEVER in the COUNTIES of GREAT BRITAIN which were Confirmed during the Year 1902; with the Number of Swine SLAUGHTERED, by order of the Board of Agriculture, as Diseased or Exposed to Infection.

COUNTIES.	Number of COUNTIES in which Swine-Fever was found to exist.	OUTBREAKS Confirmed.	Swine Slaughtered as Diseased or as having been Exposed to Infection.
GREAT BRITAIN.	67	1,688	8,263
ENGLAND	47	1,545	7,547
WALES	10	75	269
SCOTLAND	10	68	447
ENGLAND.			
Bedford		18	69
Berks		33	104
Buckingham		29	142
Cambridge		27	104
Isle of Ely		11	26
Chester		39	71
Cornwall		39	90
Derby		51	180
Devon		31	143
Dorset		7	63
Durham		20	97
Essex		79	432
Gloucester		65	308
Hants		87	312
Isle of Wight		14	106
Hereford		7	22
Hertford		27	177
Huntingdon		37	185
Kent		44	172
Lancaster		30	90
Leicester		3	2
Lincoln, Parts of Holland ..		8	15
" " Kesteven ..		2	2
" " Lindsey ..		13	31
London		2	39
Middlesex		36	383
Monmouth		10	57
Norfolk		31	168
Northampton		42	213
Soke of Peterborough ..		2	8
Northumberland		6	7
Notts		9	25
Oxford		25	108
Rutland		4	13
COUNTIES (*continued*).			
ENGLAND—*continued.*			
Salop		26	162
Somerset		39	226
Stafford		62	160
Suffolk		45	616
Surrey		43	354
Sussex, East		20	73
" West		4	18
Warwick		25	126
Wilts		54	138
Worcester		66	627
York, East Riding		34	150
" North		75	282
" West		181	554
WALES.			
Cardigan		1	1
Carmarthen		2	2
Carnarvon		8	11
Denbigh		14	54
Flint		6	32
Glamorgan		34	146
Merioneth		3	7
Montgomery		4	5
Pembroke		2	2
Radnor		1	9
SCOTLAND.			
Argyll		3	6
Ayr		43	167
Berwick		2	17
Dumfries		1	36
Lanark		5	115
Midlothian		3	29
Renfrew		2	18
Ross and Cromarty		1	1
Stirling		3	5
Wigtown		6	63

TABLE XXII.—NUMBER of OUTBREAKS of FOOT-AND-MOUTH DISEASE in t COUNTIES of GREAT BRITAIN which were confirmed during the Year 190 with the Number of Animals Attacked, and the Number Slaughtered order of the Board of Agriculture as Diseased or Exposed to Infection.

COUNTIES.	Number of COUNTIES where Disease was found to exist.	Number of Outbreaks Confirmed.	Number of Animals Attacked.			Number of Animals Slaughtered as Diseased or as having been Exposed to Infection.		
			Cattle.	Sheep.	Swine.	Cattle.	Sheep.	Swin
GREAT BRITAIN.	1	1	2	118	..	..	..	..
ENGLAND	1	1	2	118	..	..	..	..
WALES	..	..	..	..	..	..	..	..
SCOTLAND	..	..	..	..	..	..	..	..
ENGLAND.								
Kent		1	2	118	..	..	..	..

TABLE XXIII.—NUMBER of CASES of RABIES in DOGS confirmed in th COUNTIES of GREAT BRITAIN during the Year 1902; with the Numbe of Dogs reported as Destroyed in consequence of having been Exposed t Infection.

COUNTIES.	Number of COUNTIES where Disease was found to exist.	DOGS Affected (Died or Destroyed).	DOGS Destroyed as having been Exposed to Infection.
GREAT BRITAIN	4	13	70
ENGLAND	1	1	1
WALES	3	12	69
SCOTLAND	...	...	...
ENGLAND.			
Devon		1	1
WALES.			
Cardigan		2	7
Carmarthen		2	20
Pembroke		8	42

INSPECTORS OF THE LOCAL AUTHORITIES to have occurred in the with the Number of Animals reported as Attacked by the Disease.

COUNTIES (*continued*).	OUTBREAKS Reported.	ANIMALS ATTACKED.			
		Cattle.	Sheep.	Swine.	Horses.
ENGLAND (*continued*).					
Surrey .. .. — —	2	5	..	1	1
Sussex, East .. — .. — ..	5	5	..	..	..
,, West .. .. — — ..	3	7	1	..	..
Warwick .. .. —	12	18	..	1	..
Westmorland .. .. .. —	17	20	..	..	..
Wilts .. .. —	6	7	..	3	—
Worcester .. .. —	6	7	..	3	1
York, East Riding .. .. .. —	2	2	..	—	—
,, North .. .. —	11	11	6	3	—
,, West .. — .. — —	32	30	..	14	6
WALES.					
Brecon .. .. —	1	6	—	—	1
Cardigan	2	..	—	—	2
Carmarthen .. — .. .. —	5	2	4	..	—
Pembroke .. — — — ..	2	1	—	—	—
SCOTLAND.					
Aberdeen .. — — — —	93	118	—	—	6
Argyll .. — .. —	1	5	—	..	..
Ayr .. —	4	3	..	..	..
Banff .. .. — — — ..	15	17	..	..	..
Dumbarton	3	6	..	..	..
Dumfries	2	4	..	..	..
Elgin, or Moray	11	12	..	1	..
Fife .. —	8	8	..	..	..
Forfar .. —	14	25	..	—	—
Haddington —	15	19	—	—	..
Inverness .. .. — — —	1	1	—	..	1
Kincardine	6	6	—	..	..
Kirkcudbright .. .. .. —	2	2	..	..	..
Lanark .. .. — — —	6	9	..	..	..
Linlithgow .. — .. — —	3	4	..	2	..
Midlothian .. .. — — —	11	11	..	2	..
Perth .. .. — .. — —	13	17	7	..	..
Renfrew .. — — — —	4	13	..	..	..
Ross and Cromarty — — —	3	6	..	..	..
Roxburgh .. — — — ..	1	4	..	..	..
Selkirk	1	1	..	..	..
Stirling .. — — — ..	1	2	..	..	..
Wigtown	4	4	..	..	..

TABLE XXIV.—ARGENTINA.

(*Compiled from the "Estadistica del Comercio de la Republica Argentina."*)

IMPORTS.

COUNTRIES from which Imported.	CATTLE.			SHEEP.			SWINE.		
	1899.	1900.	*1901.	1899.	1900.	*1901.	1899.	1900.	*190
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No*	*No.*	*No*
BELGIUM	1	..	..	30	..	..	..	..	..
FRANCE	137	83	..	183	22	..	..	..	..
GERMANY	21	..	..	308	305	..	..	..	..
ITALY	4	..	..	..	..	..	..	..	..
SPAIN	..	17	..	..	..	..	..	..	..
UNITED KINGDOM	1,394	838	..	4,221	8,788	..	19	3	..
BOLIVIA	..	..	..	..	..	..	..	..	..
BRAZIL	25	..	..	..	..	..	..	..	..
PARAGUAY	244	838	..	..	..	..	..	..	..
UNITED STATES of AMERICA ..	4	..	..	63	50	..	..	..	..
URUGUAY	353	..	..	37,775	16,478	..	..	..	..
TOTAL	2,183	1,776	1,338	42,614	25,643	43,410	19	3	..

EXPORTS.

COUNTRIES to which Exported.	CATTLE.			SHEEP.			SWINE.		
	1890.	1900.	*1901.	1899.	1900.	*1901.	1899.	1900.	*1901
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
BELGIUM	87	286	..	1,900	1,220	..	..	..	..
FRANCE	631	31	..	91,880	14,900	..	..	..	..
GERMANY	585	186	..	2,296	709	..	..	..	..
ITALY	..	..	..	..	..	..	..	..	..
PORTUGAL	10	..	..	..	..	..	..	..	..
UNITED KINGDOM	91,254	34,026	..	406,747	160,316	..	..	..	..
AFRICA	1,758	2,980	..	3,776	7,502	..	..	40	..
BOLIVIA	4,389	5,733	..	6,704	5,310	..	..	..	..
BRAZIL	22,325	24,113	..	4,054	757	..	1,830	..	..
CHILE	16,748	22,501	..	856	3,296	..	..	..	..
PARAGUAY	146	16	..	..	..	..	..	..	..
PERU	..	..	..	..	3,000	..	..	..	..
UNITED STATES of AMERICA ..	..	..	..	..	..	..	..	..	..
URUGUAY	174,217	60,690	..	24,756	2,005	..	..	..	..
TOTAL	312,150	150,550	119,189	545,458	198,102	26,746	1,830	40	25

* The details for the separate countries in 1901 were not available at the time of publication of this Report.

TABLE XXI.—NUMBER of Outbreaks of SHEEP-SCAB reported by the INSPECTORS OF THE LOCAL AUTHORITIES to have occurred in the COUNTIES of GREAT BRITAIN, during the Year 1902; and the Number of Sheep reported as Attacked by the Disease.

COUNTIES.	Number of COUNTIES where Disease was found to exist.	OUT-BREAKS Reported.	SHEEP ATTACKED.
GREAT BRITAIN.	73	1,664	25,133
ENGLAND ..	38	691	13,653
WALES ..	11	779	8,874
SCOTLAND ..	24	194	3,744

COUNTIES.	OUT-BREAKS Reported.	SHEEP ATTACKED.
ENGLAND.		
Bedford	2	19
Berks	1	234
Buckingham	8	338
Chester	57	669
Cumberland	41	309
Derby	42	633
Devon	21	1,087
Dorset	2	139
Durham	22	391
Essex	10	447
Gloucester	22	709
Hereford	43	319
Hertford	1	122
Huntingdon	2	3
Kent	13	258
Lancaster	29	159
Leicester	7	125
Lincoln, Parts of Holland ..	2	29
" " Lindsey ..	3	37
Monmouth	108	917
Norfolk	1	3
Northampton	13	387
Northumberland	7	53
Notts	3	36
Salop	24	256
Somerset	31	1,308
Stafford	26	313
Suffolk	1	238
Surrey	1	40
Sussex, East	8	68
" West	3	273
Warwick	15	802
Westmorland	9	37
Wilts	2	44
ENGLAND—*continued.*		
Worcester	7	207
York, East Riding	15	136
" North	25	230
" West	94	958
WALES.		
Anglesey	57	334
Brecon	150	1,067
Cardigan	34	390
Carmarthen	19	332
Carnarvon	78	624
Denbigh	108	995
Flint	16	113
Glamorgan	52	445
Merioneth	132	1,597
Montgomery	115	1,124
Radnor	7	71
SCOTLAND.		
Aberdeen	29	281
Argyll	9	48
Ayr	12	108
Banff	15	115
Berwick	5	88
Caithness	3	26
Dumbarton	2	18
Dumfries	3	18
Elgin, or Moray	9	60
Fife	7	61
Forfar	4	46
Inverness	4	78
Kinross	1	26
Kirkcudbright	3	41
Lanark	3	56
Linlithgow	6	43
Midlothian	6	140
Nairn	9	54
Perth	9	95
Renfrew	3	73
Ross and Cromarty ..	46	317
Roxburgh	1	25
Stirling	4	36
Sutherland	1	8

TABLE XXII.—NUMBER of OUTBREAKS of FOOT-AND-MOUTH DISEASE in the COUNTIES of GREAT BRITAIN which were confirmed during the Year 1902: with the Number of Animals Attacked, and the Number Slaughtered by order of the Board of Agriculture as Diseased or Exposed to Infection.

COUNTIES.	Number of COUNTIES where Disease was found to exist.	Number of Outbreaks Confirmed.	Number of Animals Attacked.			Number of Animals Slaughtered as Diseased or as having been Exposed to Infection.		
			Cattle.	Sheep.	Swine.	Cattle.	Sheep.	Swine.
GREAT BRITAIN.	1	1	2	118	..	...	..	..
ENGLAND	1	1	2	118	..	..	..	..
WALES	..	—	..	..	..	..	..	..
SCOTLAND	...	..	..	..	..	..	..	..
ENGLAND.								
Kent		1	2	118	..	..	...	..

TABLE XXIII.—NUMBER of CASES of RABIES in DOGS confirmed in the COUNTIES of GREAT BRITAIN during the Year 1902; with the Number of Dogs reported as Destroyed in consequence of having been Exposed to Infection.

COUNTIES.	Number of COUNTIES where Disease was found to exist.	Dogs Affected (Died or Destroyed).	Dogs Destroyed as having been Exposed to Infection.
GREAT BRITAIN	4	13	70
ENGLAND	1	1	1
WALES	3	12	69
SCOTLAND	...	...	...
ENGLAND.			
Devon		1	1
WALES.			
Cardigan		2	7
Carmarthen		2	20
Pembroke		8	42

Tables XXIV. *to* XXXVIII.

INTERNATIONAL TRADE IN ANIMALS.

Note.—The following Tables are compiled from the Official Trade Statistics of the several Countries named. They are prepared with the view of showing what movements of live animals are recorded as taking place between the States in question. The figures represent, so far as the records permit,—

1.—The Imports of Cattle, Sheep, and Swine into each Country, distinguishing the Countries whence the animals are stated to have come.

2.—The Exports of Cattle, Sheep, and Swine from each of the Countries named, showing the Countries to which the animals are stated to have been sent.

The varying forms and methods of the Trade Accounts of different Countries preclude the numbers of imported and exported animals from being in agreement in all cases, and the data must be accepted as approximate only.

TABLE XXIV.—ARGENTINA.

(Compiled from the "Estadística del Comercio de la República Argentina.")

IMPORTS.

COUNTRIES from which Imported.	CATTLE.			SHEEP.			SWINE.		
	1899.	1900.	*1901.	1899.	1900.	*1901.	1899.	1900.	*1901.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
BELGIUM	1	—	..	30	—	—	..	..	..
FRANCE	157	85	..	120	22	..	..	..	..
GERMANY	22	..	..	106	286	..	..	..	..
ITALY	6	..	..	..	..	..	..	..	..
SPAIN	..	17	..	..	..	..	..	..	..
UNITED KINGDOM	1,[illegible]	856	..	6,[illegible]	8,[illegible]	..	10	3	..
BOLIVIA	..	..	..	..	..	—	..	..	..
BRAZIL	16	..	..	..	..	—	..	..	..
PARAGUAY	264	850	..	—	..	—	..	..	..
UNITED STATES of AMERICA ..	4	—	..	61	50	—	..	..	..
URUGUAY	302	..	—	32,275	18,678	—	..	..	..
TOTAL	2,[illegible]	1,778	1,326	42,604	23,[illegible]	43,613	16	3	..

EXPORTS.

COUNTRIES to which Exported.	CATTLE.			SHEEP.			SWINE.		
	1899.	1900.	*1901.	1899.	1900.	*1901.	1899.	1900.	*1901.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
BELGIUM	97	260	..	1,900	1,220	..	—	..	..
FRANCE	621	31	..	61,500	14,900	..	—	..	..
GERMANY	565	189	..	2,296	799	..	—	..	..
ITALY	—	..	..	..	..	..	—	..	..
PORTUGAL	10	..	..	..	..	..	—	..	..
UNITED KINGDOM	90,[illegible]	36,[illegible]	..	496,767	180,358	..	—	..	..
AFRICA	3,238	2,840	..	3,774	7,800	..	..	40	..
BOLIVIA	4,309	3,733	..	6,796	3,380	..	..	..	..
BRAZIL	23,321	20,113	..	4,604	777	..	1,830	..	..
CHILE	16,788	21,502	..	656	2,200	—	..	..	..
PARAGUAY	166	18	..	—	—	—	..	..	..
PERU	—	..	..	—	3,000	—	..	..	..
UNITED STATES of AMERICA ..	—	..	..	..	—	—	..	..	—
URUGUAY	174,137	60,879	—	20,764	2,905	—	..	..	..
TOTAL	303,104	150,550	119,189	540,468	239,102	18,548	1,830	40	258

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* The details for the separate countries in 1901 were not available at the time of publication of this Report.

TABLE XXV.—AUSTRIA-HUNGARY.

(Compiled from the "Statistik des Auswärtigen Handels des Oesterreichisch-Ungarischen Zollgebiets.")

IMPORTS.

COUNTRIES from which Imported.	CATTLE.			SHEEP.			SWINE.		
	1899.	1900.	1901.	1899.	1900.	1901.	1899.	1900.	1901.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
FRANCE	..	10	..	4	..	..	1	—	..
GERMANY	985	997	714	152	124	179	2,971	1,300	943
GREECE	..	..	..	8	5	..	—	—	—
ITALY	5,492	8,347	5,800	514	1,570	391	79	13	17
MONTENEGRO	399	756	911	5,060	11,207	13,004	2,061	2,094	2,409
NETHERLANDS	..	10	..	..	..	..	—	—	—
ROUMANIA	3	4	19	3,065	3,790	1,053	591	533	403
RUSSIA...	4	..	..	..	300	129	—	8	—
SERVIA	71,489	62,741	40,509	4,992	7,040	3,800	83,307	89,213	107,704
SWITZERLAND	371	261	189	145	..	—	2	—	—
TURKEY	3	4	6	299	35	..	5	—	—
UNITED KINGDOM	..	..	1	..	18	..	52	18	51
EGYPT	..	..	..	..	1	..	—	—	—
INDIA	..	1	..	—	..	—	—	—	—
JAPAN	..	1	..	—	..	—	..	—	—
UNITED STATES of AMERICA ...	..	4	..	..	—	—	51	—	—
TOTAL	78,217	74,508	50,860	13,805	23,799	19,285	87,808	96,082	113,656

EXPORTS.

COUNTRIES to which Exported.	CATTLE.			SHEEP.			SWINE.		
	1899.	1900.	1901.	1899.	1900.	1901.	1899.	1900.	1901.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
BELGIUM	2	5	..	2,526	5,094	4,713	—	..	..
BULGARIA	7	..	4	..	..	..	..	..	..
FRANCE	..	..	..	15,107	17,280	24,841	..	..	..
GERMANY	144,303	147,730	150,671	1,290	771	479	22	78	39
ITALY	2,151	4,061	3,327	101	254	116	50	79	384
ROUMANIA	1,805	166	287	101,807	6,808	82,043	62	1	33
RUSSIA..	853	83	68	11	..	118	80	4	5
SERVIA	47	66	32	35	..	..	3	..	19
SWITZERLAND	3,003	3,327	7,343	14,327	13,719	16,461	4,021	7,313	12,787
TURKEY	..	1	..	..	..	..	10	..	..
UNITED KINGDOM	..	*1	..	..	..	..	..	..	..
EGYPT	..	..	3	..	..	..	..	..	..
INDIA	..	3	13	..	..	..	..	..	..
[illegible]	..	..	2	..	..	..	..	..	..
TOTAL	156,386	156,327	171,968	152,902	44,400	96,175	4,917	7,423	13,306

* This animal was not received alive at any port in the United Kingdom.

TABLE XXVI.—BELGIUM.

(*Compiled from the "Tableau Général du Commerce avec les Pays Étrangers."*)

IMPORTS.

COUNTRIES from which Imported.	CATTLE.			SHEEP.			SWINE.		
	1899.	1900.	1901.	1899.	1900.	1901.	1899.	1900.	1901.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
AUSTRIA	*	*	*	*	602	3,900	*	*	*
FRANCE	3,262	300	89	*	*	170	*	*	*
GERMANY	67	80	59	71,780	40,168	74,181	*	*	11
LUXEMBURG	*	*	*	813	1,304	4,244	*	*	*
NETHERLANDS	63,580	64,039	62,717	96,656	95,580	80,481	690	333	[illegible]
SWITZERLAND	12	*	1	*	*	*	*	*	*
UNITED KINGDOM	13	*	*	*	*	*	*	5	*
UNITED STATES	*	*	89	*	*	*	*	*	*
ARGENTINA..	472	318	*	4,077	4,302	*	90	*	*
OTHER COUNTRIES	60	31	136	287	72	1,230	22	4	32
TOTAL	66,145	64,483	62,962	189,875	147,129	164,403	906	347	[illegible]

EXPORTS.

COUNTRIES to which Exported.	CATTLE.			SHEEP.			SWINE.		
	1899.	1900.	1901.	1899.	1900.	1901.	1899.	1900.	1901.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
FRANCE	*	4	*	22	2	*	*	*	*
GERMANY	22	48	38	18	80	*	117	19	41
LUXEMBURG	*	34	78	38	*	*	*	*	*
NETHERLANDS	994	3,862	4,347	326	*	7	889	1,029	[illegible]
SPAIN..	*	*	*	*	*	*	*	*	6
ARGENTINA	*	*	*	20	*	*	*	*	*
BRAZIL	*	*	*	*	2	*	*	*	*
CANADA	35	*	*	*	*	178	*	*	*
MEXICO	38	*	*	*	*	*	*	*	*
OTHER COUNTRIES	31	8	34	*	*	12	9	*	*
TOTAL	1,096	3,958	4,499	379	86	197	1,016	1,028	[illegible]

* Included (if any) with "Other Countries."

TABLE XXVII.—CANADA.

(Compiled from the Tables of the Trade and Navigation of the Dominion of Canada.)

IMPORTS.

COUNTRIES from which Imported.	CATTLE.			SHEEP.			SWINE.		
	1899.†	1900.†	1901.†	1899.†	1900.†	1901.†	1899.†	1900.†	1901.†
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
SWITZERLAND	28	..	..	..	..	..	..	..	..
FRANCE	..	..	16	..	..	..	..	..	..
GERMANY	..	..	15	..	300	..	..	..	..
UNITED KINGDOM	116	340	340	338	742	463	79	9	‡ 38 *Lbs.* 300
NEWFOUNDLAND	1	..	..	..	..	..	3	..	..
UNITED STATES of AMERICA ..	2,119	3,314	8,473	34,273	45,731	41,342	‡ 44 *Lbs.* 101,110	‡ 47 *Lbs.* 148,768	*No.* ‡ 60 *Lbs.* 144,478
TOTAL	2,264	3,654	8,867	34,611	46,804	42,073	..	..	..

EXPORTS.

COUNTRIES to which Exported.	CATTLE.			SHEEP.			SWINE.		
	1899.†	1900.†	1901.†	1899.†	1900.†	1901.†	1899.†	1900.†	1901.†
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
BELGIUM	..	..	481	*	..	2,338	..	..	..
SWITZERLAND	29	..	..	..	..	..	..	..	..
UNITED KINGDOM	114,053	113,030	119,034	42,465	29,294	71,022	..	..	..
ARGENTINA	..	..	211	*	..	..	..	..	..
BRITISH GUIANA	22	1	..	144	90	110	29	..	..
NEWFOUNDLAND	2,099	2,115	2,043	2,547	3,000	3,445	116	105	48
ST. PIERRE	1,324	1,261	1,254	2,346	2,387	2,006	404	461	272
UNITED STATES of AMERICA ..	92,004	96,989	90,807	324,207	374,512	300,987	149	1,075	550
WEST INDIES, BRITISH	111	72	59	2,369	915	955	52	5	34
OTHER COUNTRIES	..	..	1	39	..	..	..	..	..
TOTAL	232,349	295,526	199,337	406,354	410,944	394,045	834	1,654	960

* Included (if any) with "Other Countries."

† Fiscal Years ending 30th June.

‡ Imported, free of duty, for breeding purposes.

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TABLE XXVIII.—DENMARK.

(Compiled from "Danmarks Statistik: Vare Indførsel og Udførsel.")

IMPORTS.

COUNTRIES from which Imported.	CATTLE.			SHEEP.*			SWINE.		
	1899.	1900.	1901.	1899.	1900.	1901.	1899.	1900.	1901.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
FAROE ISLANDS	..	..	..	..	67	..	..	..	—
GERMANY	2	..	2	2	...	25	..	..	..
NORWAY	...	1	...	..	..	..	...	..	..
RUSSIA	..	..	..	..	—	3	...	..	..
SWEDEN	1,236	1,861	[illegible]	1,476	1,280	779	17	115	[illegible]
UNITED KINGDOM	...	...	[illegible]	6	...	1	37	..	—
TOTAL	1,238	1,862	[illegible]	1,484	1,347	808	54	115	[illegible]

EXPORTS.

COUNTRIES to which Exported.	CATTLE.			SHEEP.*			SWINE.		
	1899.	1900.	1901.	1899.	1900.	1901.	1899.	1900.	1901.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
FRANCE	1	..	..	[illegible]	[illegible]	..	...	—	..
GERMANY	[illegible]	40,302	41,302	375	190	48	..	—	..
NORWAY	..	..	8	..	..	..	3	—	[illegible]
RUSSIA	178	[illegible]	211	4	6	13	105	30	[illegible]
SWEDEN	15	67	21	..	..	7	...	—	..
FAROE ISLANDS	..	..	7	..	..	..	...	..	..
ICELAND	..	..	..	..	..	..	...	—	[illegible]
GREENLAND	...	4	4	..	45	8	...	—	[illegible]
TOTAL	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	76	108	30	[illegible]

* Including Goats.

TABLE XXIX.—FRANCE.

(*Compiled from the "Tableau général du Commerce de la France."*)

IMPORTS.

COUNTRIES from which Imported.	CATTLE.			SHEEP.			SWINE.		
	1899.	1900.	1901.	1899.	1900.	1901.	1899.	1900.	1901.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
AUSTRIA-HUNGARY	*	*	*	11,796	[illegible]	[illegible]	*	*	*
DENMARK	*	*	*	[illegible]	[illegible]	[illegible]	*	*	*
GERMANY	*	*	*	[illegible]	[illegible]	30,511	*	*	*
ITALY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NEUTRAL ZONE (Gex and Savoy)	[illegible]	[illegible]	[illegible]	1,707	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RUSSIA	*	*	*	17,448	[illegible]	[illegible]	*	*	*
SPAIN	[illegible]	[illegible]	561	*	[illegible]	[illegible]	*	[illegible]	[illegible]
TURKEY	*	*	*	[illegible]	[illegible]	[illegible]	*	*	*
UNITED KINGDOM	49	[illegible]	[illegible]	*	*	*	[illegible]	[illegible]	[illegible]
ALGERIA	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1,176,790	[illegible]	[illegible]	*
ARGENTINA	[illegible]	34	1	[illegible]	[illegible]	*	*	*	*
TUNIS	[illegible]	[illegible]	[illegible]	*	[illegible]	580	*	*	*
OTHER FRENCH COLONIES and Dependencies	*	*	*	[illegible]	*	7	[illegible]	8	[illegible]
OTHER COUNTRIES	297	[illegible]	[illegible]	[illegible]	[illegible]	1,147	[illegible]	[illegible]	[illegible]
TOTAL	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	41,657	[illegible]	[illegible]

EXPORTS.

COUNTRIES to which Exported.	CATTLE.			SHEEP.			SWINE.		
	1899.	1900.	1901.	1899.	1900.	1901.	1899.	1900.	1901.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
BELGIUM	[illegible]	135	[illegible]	*	*	175	*	[illegible]	[illegible]
GERMANY	[illegible]	[illegible]	[illegible]	*	*	*	[illegible]	[illegible]	[illegible]
ITALY	*	[illegible]	*	[illegible]	[illegible]	[illegible]	[illegible]	*	*
NEUTRAL ZONE (Gex and Savoy)	[illegible]	7,676	[illegible]	[illegible]	[illegible]	[illegible]	11,561	[illegible]	[illegible]
SPAIN	[illegible]	12,147	[illegible]	[illegible]	1,415	[illegible]	[illegible]	[illegible]	798
SWITZERLAND	[illegible]	17,701	13,500	[illegible]	[illegible]	[illegible]	24,180	[illegible]	16,531
UNITED KINGDOM	—	—	—	[illegible]	—	—	—	—	—
ALGERIA	[illegible]	[illegible]	1,575	*	182	*	*	*	3
ARGENTINA	[illegible]	[illegible]	*	*	*	*	*	*	*
CHILE	*	*	4	*	*	*	*	*	*
TUNIS	[illegible]	7	344	*	*	*	*	*	*
OTHER FRENCH COLONIES and Dependencies	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3	214	[illegible]
OTHER COUNTRIES†	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TOTAL	[illegible]	[illegible]	[illegible]	[illegible]	44,367	[illegible]	[illegible]	[illegible]	[illegible]

* Included (if any) with "Other Countries." † Including Ships' stores.
‡ These animals were not received alive at any port in the United Kingdom.

TABLE XXX.—GERMANY.†

(*Compiled from the "Statistik des Deutschen Reiches: Waarenverkehr des Deutschen Zollgebiets mit dem Auslande."*)

IMPORTS.

COUNTRIES from which Imported.	CATTLE.			SHEEP.			SWINE.		
	1899.	1900.	1901.	1899.	1900.	1901.	1899.	1900.	1901.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
AUSTRIA-HUNGARY	149,382	152,069	165,465	*	*	*	*	*	148
BELGIUM	37	*	*	*	*	*	*	*	*
DENMARK	36,532	42,606	41,706	431	*	*	*	*	*
FRANCE	3,193	3,862	3,443	*	*	*	300	403	4,059
NETHERLANDS	118	59	64	*	*	*	*	*	*
RUSSIA	*	*	*	*	*	*	69,729	67,969	72,699
SWITZERLAND	8,020	15,302	27,073	*	*	*	*	*	*
UNITED KINGDOM	*	23	51	485	626	495	104	*	*
OTHER COUNTRIES §	573	488	533	281	60	210	943	1,359	1,653
TOTAL	197,854	214,409	238,335	1,197	686	705	71,076	69,731	78,559

EXPORTS.

COUNTRIES to which Exported.	CATTLE.			SHEEP.			SWINE.		
	1899.	1900.	1901.	1899.	1900.	1901.	1899.	1900.	1901.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
AUSTRIA-HUNGARY	822	754	679	*	*	*	2,106	1,401	130
BELGIUM	*	*	*	66,927	66,456	65,631	*	*	*
FRANCE..	*	*	*	14,512	17,704	29,735	*	*	*
RUSSIA	339	252	170	459	284	169	89	89	*
SWITZERLAND	4,107	5,425	7,575	21,555	16,276	27,236	2,531	1,853	366
UNITED KINGDOM	*	*	*	‡33,475	‡61,413	‡72,081	*	*	*
ARGENTINA	*	*	*	417	265	104	*	*	*
AUSTRALIA	*	*	*	34	14	*	*	*	*
BRITISH SOUTH AFRICA	*	*	*	91	*	*	*	*	*
CANADA	*	*	*	110	359	281	*	*	*
URUGUAY	*	*	*	110	122	79	*	*	*
VENEZUELA	*	*	*	*	*	*	114	*	*
OTHER COUNTRIES §	372	326	223	1,311	1,011	1,746	1,846	1,710	2,097
TOTAL	5,640	6,757	8,647	140,991	163,904	197,062	6,686	5,053	2,593

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* Included (if any) with "Other Countries."
† Exclusive of those parts of Germany which are not included in the German Customs Union.
‡ These sheep were not received alive at any port in the United Kingdom.
§ Including those parts of Germany which are not included in the German Customs Union.

TABLE XXXI.—ITALY.

(*Compiled from the "Movimento Commerciale del Regno d'Italia."*)

IMPORTS.

COUNTRIES from which Imported.	CATTLE.			SHEEP.			SWINE.		
	1899.	1900.	1901.	1899.	1900.	1901.	1899.	1900.	1901.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
AUSTRIA-HUNGARY	5,949	5,571	4,979	2,143	2,560	1,472	59	59	255
FRANCE	124	132	166	219	238	321	126	97	..
NETHERLANDS	107	93	117	..	..	..	..	..	..
ROUMANIA	..	631	350	..	..	..	245	742	640
MONTENEGRO	31	..	17	1,627	355	880	..	..	..
SWITZERLAND	10,289	7,976	7,863	..	..	..	1,152	1,337	1,421
TURKEY in EUROPE	65	..	..	1,228	..	..	..	180	..
TUNIS	335	250	449	..	..	53	..	..	..
TOTAL	16,900	14,652	13,941	5,217	3,153	2,726	1,582	2,415	2,316

EXPORTS.

COUNTRIES, to which Exported.	CATTLE.			SHEEP.			SWINE.		
	1899.	1900.	1901.	1899.	1900.	1901.	1899.	1900.	1901.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
AUSTRIA-HUNGARY	3,409	8,342	3,065	243	4,243	289	46	86	..
FRANCE	6,963	4,658	1,355	21,376	17,659	12,742	13,091	5,147	3,440
GERMANY	181	227	313	..	..	396	52	116	948
MALTA	56	24	..	..	..	..	1,484	1,056	923
NETHERLANDS	104	107	141	..	..	..	..	..	..
RUSSIA..	..	5	..	..	..	..	..	..	..
SPAIN	890	1,069	568	..	..	..	..	..	..
SWITZERLAND	28,191	31,896	28,030	13,827	19,497	21,864	58,483	46,226	42,650
UNITED KINGDOM	*71	*95	*93	*138	..	*100	*133	*23	..
TUNIS	303	187	170	..	173	202	102	118	40
TOTAL	40,168	46,610	33,705	35,584	41,471	35,593	73,391	52,772	48,001

* These animals were not received alive at any port in the United Kingdom.

TABLE XXXII.—NETHERLANDS.

(*Compiled from the "Statistiek van den In-Uit-en-Doorvoer der Nederlande."*)

IMPORTS.

COUNTRIES from which Imported.	CATTLE.			SHEEP.			SWINE.		
	1899.	1900.	1901.	1899.	1900.	1901.	1899.	1900.	1901.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
BELGIUM	1,273	1,762	1,636	316	..	8	11	979	8
FRANCE	..	..	..	2	..	..	..	..	..
GERMANY	28	17	17	33,890	62,175	76,544	..	..	2
GREECE	..	..	..	1	1	..	..	6	..
ROUMANIA	50	3	..	1	..	..	10	10	..
RUSSIA	..	..	1	7	..	..	15	..	15
SPAIN	..	..	..	3	1	4	..	..	1
SWEDEN	..	..	..	10	..	..	12	..	..
TURKEY	..	..	..	1	1	..	..	..	..
UNITED KINGDOM	5	..	..	31	12	31	22	6	1
AFRICA, WEST	..	..	..	..	..	..	..	..	9
ALGERIA	..	..	..	2	..	..	8	..	..
CENTRAL AMERICA	..	..	..	..	..	..	1	..	..
EAST INDIES, BRITISH	..	..	..	3	..	..	..	..	..
SOUTH AMERICA	..	..	..	80	31	..	4	..	3
UNITED STATES of AMERICA	..	..	..	8	..	..	4	..	..
TOTAL	1,356	1,782	1,654	34,355	62,221	76,587	87	1,001	39

EXPORTS.

COUNTRIES to which Exported.	CATTLE.			SHEEP.			SWINE.		
	1899.	1900.	1901.	1899.	1900.	1901.	1899.	1900.	1901.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
AUSTRIA-HUNGARY	1	..	..	..	..	..	..	..	..
BELGIUM	49,438	53,317	43,880	74,126	69,373	67,850	5,392	3,101	2,979
GERMANY	250	148	302	4	5	1	1	..	..
GIBRALTAR	1	..	..	..	..	..	..	..	..
GREECE	51	..	..	..	..	..	1	..	..
ITALY	107	..	..	..	..	..	..	..	..
PORTUGAL	..	..	29	..	..	..	..	..	2
ROUMANIA	..	..	..	1	..	..	7	7	..
RUSSIA	237	65	77	..	..	..	4	..	..
SPAIN	1,251	1,569	2,194	1	2	1	..	..	..
SWEDEN	..	..	..	..	..	..	10	..	..
UNITED KINGDOM	*55	*2	*1	*154	*30	*6	*64	*9	*32
AFRICA	16	11	11	154	61	143	6	11	9
ARGENTINA	..	..	1	..	..	..	..	1	16
BRAZIL	..	..	..	..	..	..	2	..	..
CHINA	..	..	..	..	..	..	..	6	..
EAST INDIES, DUTCH	8	21	6	..	8	..	311	318	336
GUIANA, DUTCH	9	13	14	..	..	..	95	99	101
JAPAN	..	..	33	..	..	20	..	..	..
PERU AND BOLIVIA	..	..	..	..	..	..	..	2	..
UNITED STATES of AMERICA	..	..	16	7	2	2	4	2	7
TOTAL	51,433	55,146	46,564	74,447	69,481	68,023	5,897	3,556	3,482

* These animals were not received alive at any port in the United Kingdom.

TABLE XXXIII.—NORWAY.

(*Compiled from "Norges Officielle Statistik : Norges Handel."*)

IMPORTS.

COUNTRIES from which Imported.	CATTLE.			SHEEP.			SWINE.		
	1899.	1900.	1901.	1899.	1900.	1901.	1899.	1900.	1901.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
DENMARK	..	6	*	..	..	..	3	3	*
FAROE ISLANDS	..	..	..	..	..	2	..	..	..
GERMANY	..	*	*	2	..	..	18	..	*
ICELAND	..	*	..	993	1,409	..	42	..	4
RUSSIA	17	*	23	33	60	42	..	..	..
SWEDEN	13,327	13,882	18,147	1,364	1,274	1,487	2	1	4
UNITED KINGDOM	..	*	..	..	7	11	23	..	8
OTHER COUNTRIES	..	7	4	..	..	..	..	..	3
TOTAL	13,344	13,895	18,174	2,392	2,753	1,542	88	4	19

EXPORTS.

COUNTRIES to which Exported.	CATTLE.			SHEEP.			SWINE.		
	1899.	1900.	1901.	1899.	1900.	1901.	1899.	1900.	1901.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
RUSSIA	..	†	†	1	†	†	..	†	†
SWEDEN	7	†	†	35	†	†	..	†	†
TOTAL	7	11	44	36	[illegible]	48	..	67	173

* Included (if any) with "Other Countries." † Countries not distinguished in 1900 and 1901.

TABLE XXXIV.—PORTUGAL.

(*Compiled from the "Estatistica de Portugal, Commercio com Paizes Estrangeiros."*)

IMPORTS.

COUNTRIES from which Imported.	CATTLE.			SHEEP.			SWINE.		
	1899.	1900.	1901.	1899.	1900.	1901.	1899.	1900.	1901.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
FRANCE	..	..	6	2	..	..	..	..	1
GERMANY	..	..	..	2	..	..	..	..	—
NETHERLANDS	..	..	20	..	..	..	—	..	—
SPAIN	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
UNITED KINGDOM	1	4	28	..	2	2	..	6	..
ARGENTINA	10	..	..	..	—	..	..	..	..
BRAZIL	..	..	..	..	..	..	2	1	[illegible]
MOROCCO	..	300	..	..	..	..	..	..	..
PORTUGUESE POSSESSIONS ..	..	..	..	5	2	..	—	..	7
UNITED STATES of AMERICA ..	..	..	..	..	..	..	2	3	7
TOTAL	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

EXPORTS.

COUNTRIES to which Exported.	CATTLE.			SHEEP.			SWINE.		
	1899.	1900.	1901.	1899.	1900.	1901.	1899.	1900.	1901.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
FRANCE	—	..	..	..	..	..	..	1	—
SPAIN	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
UNITED KINGDOM	[illegible]	[illegible]	[illegible]	145	..	..	..	..	..
BRAZIL	[illegible]	[illegible]	[illegible]	[illegible]	19	..	..	..	[illegible]
PORTUGUESE POSSESSIONS ..	[illegible]	[illegible]	29	5	2	9	9	10	[illegible]
UNITED STATES of AMERICA ..	1	2	2	..	..	—	—	..	—
TOTAL	[illegible]	[illegible]	[illegible]	[illegible]	405,016	[illegible]	[illegible]	[illegible]	[illegible]

† These animals were not received alive at any port in the United Kingdom.

TABLE XXXV.—RUSSIA.

(*Compiled from the "Obsor Vnyeshnei Torgovli Rossii."*)

IMPORTS.

COUNTRIES from which Imported.	CATTLE, Excluding Calves.		SHEEP AND CALVES.		SWINE.	
	1899.	1900.	1899.	1900.	1899.	1900.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*
AUSTRIA-HUNGARY	129	60	2	29	23	1
DENMARK	181	158	5	35	41	19
FINLAND	8,997	10,481	710	1,171	10,231	9,987
GERMANY	490	282	200	89	63	65
HOLLAND	134	35	..	30	..	..
ROUMANIA	16,481	8,417	3,777	841	6,169	500
TURKEY	3,542	4,281	2,496	1,069	..	..
UNITED KINGDOM	24	33	39	45	21	224
AFGHANISTAN	4	204	91,534	85,984	..	..
CHINA	15,394	19,201	165,139	151,125	..	..
PERSIA	8,949	3,398	160,036	79,819	..	..
TOTAL ..	54,315	46,520	434,238	320,237	16,547	10,777

EXPORTS.

COUNTRIES to which Exported.	CATTLE.		SHEEP.		SWINE.	
	1899.	1900.	1899.	1900.	1899.	1900.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*
AUSTRIA-HUNGARY	..	1	..	1	..	2
FINLAND	..	1	..	..	200	340
FRANCE	..	..	20,405	24,566	..	..
GERMANY	252	34	134	169	63,436	66,093
GREECE	775	620	3,307	..	10	..
HOLLAND	..	..	500	5,253	..	..
ITALY	..	170	..	..	..	..
ROUMANIA	2	..	..	101	143	..
TURKEY	2,458	3,556	35,454	4,372	..	..
UNITED KINGDOM	†3,221	†3,373	..	..	†139	..
AFGHANISTAN	57	7	562	..	..	..
CHINA	1,400	159	20,877	6,091	627	100
EGYPT	1,009	1,509	9,804	4,108	..	..
PERSIA	389	152	18,353	9,406	..	..
TOTAL	9,543	9,582	109,196	54,067	64,547	66,535

† These animals were not received alive at any port in the United Kingdom.

TABLE XXXVI.—SPAIN.

(*Compiled from the "Estadistica General del Comercio Exterior de España."*)

IMPORTS.

COUNTRIES from which Imported	CATTLE.			SHEEP.*			SWINE.		
	1899	1900.	1901.	1899.	1900.	1901.	1899.	1900.	1901.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
BELGIUM	..	..	4	4	3	..	..	..	6
FRANCE†	1,960	3,633	2,493	772	678	1,930	69	131	38
GERMANY	368	..	156	12	3	2	..	..	..
GIBRALTAR	..	689	478	1	15	38	..	2	1
ITALY	651	67	31	7	1	..	..	2	..
NETHERLANDS	1,019	1,643	2,268	..	..	1	..	..	..
NORWAY	..	2	..	1	1	..	..	..	..
PORTUGAL	7,564	11,069	9,553	299,514	497,965	395,429	19,206	43,336	31,17
SWITZERLAND	54	..	..	2	..	..	..	..	..
UNITED KINGDOM	7	..	..	26	11	15	2	..	..
ALGERIA	738	727	572	750	1,138	41	..	..	..
ARGENTINA	..	..	2	29	1	1	..	..	..
BRAZIL..	..	..	..	4	..	..	..	..	..
CUBA	2	..	..	10	..	..	..	..	..
JAPAN..	..	..	..	62	..	..	..	..	..
MEXICO	..	..	..	2	1	2	..	..	..
MOROCCO	4,706	8,311	13,152	17	..	5	4	..	..
SPANISH POSSESSIONS	11	..	..	..	6	24	..	..	..
UNITED STATES OF AMERICA..	..	..	1	..	..	..	..	..	2
OTHER COUNTRIES	109	2	..	36	4	..	1	..	..
TOTAL	17,266	20,063	28,710	301,238	500,027	397,478	19,282	43,471	31,225

EXPORTS.

COUNTRIES to which Exported.	CATTLE.			SHEEP.			SWINE.		
	1899.	1900.	1901.	1899.	1900.	1901.	1899.	1900.	1901.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
FRANCE†	610	1,110	223	2,716	646	34,573	64	287	282
GERMANY	..	..	..	..	..	2	..	..	..
GIBRALTAR	103	959	700	4,050	3,274	660	1,143	334	328
ITALY	..	2	..	..	..	..	..	..	..
PORTUGAL	26,906	43,604	54,238	45,210	77,938	118,722	17,440	39,303	49,888
UNITED KINGDOM..	‡404	..	..	22	..	23	..	..	..
ALGERIA	1	4	2	..	..	52	..	..	2
ARGENTINA	11	22	20	..	..	..	..	..	..
CUBA	3	..	29	..	..	..	..	..	..
MEXICO	20	8	12	..	..	12	..	..	..
SPANISH POSSESSIONS	6	8	13	1	..	..	443	274	289
UNITED STATES OF AMERICA ..	..	..	3	..	..	..	..	..	..
URUGUAY	..	..	306	4	..	..	..	..	..
OTHER COUNTRIES	..	..	..	1,024	..	1	..	..	..
TOTAL	28,064	45,717	55,547	53,007	81,868	154,025	19,090	40,198	50,789

* Including Goats and other Animals not distinguished.

† Including Andorra. ‡ These animals were not received alive at any port in the United Kingdom.

TABLE XXXVII.—SWEDEN.

(*Compiled from "Bidrag till Sveriges Officiela Statistik : Utrikes Handel och Sjöfart.*)

IMPORTS.

COUNTRIES from which Imported.	CATTLE.			SHEEP.			SWINE.		
	1899.	1900.	1901.	1899.	1900.	1901.	1899.	1900.	1901.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*Kilos.**	*Kilos.**	*Kilos.**
DENMARK	65	124	326	1	..	9	104	..	199
FINLAND	1,785	1,455	2,196	12	34	17	10,940	6,062	10,084
NORWAY	46	39	49	71	57	46	720	937	1,199
UNITED KINGDOM	80	154	..	12	4	..	344	283	..
TOTAL	1,976	1,772	2,571	96	95	72	12,108	7,282	11,482

EXPORTS.

COUNTRIES to which Exported.	CATTLE.			SHEEP.			SWINE.		
	1899.	1900.	1901.	1899.	1900.	1901.	1899.	1900.	1901.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*Kilos.**	*Kilos.**	*Kilos.**
DENMARK	1,134	1,957	967	2,116	2,049	891	700	2,403	740
FINLAND	32	11	..	..	5	..	500	76	150
GERMANY	18	..	..	..	..	4	..	..	..
NORWAY	2,283	1,852	2,329	839	633	666	..	..	..
TOTAL	3,467	3,820	3,296	2,955	2,687	1,561	1,200	2,479	890

* The *Kilogramme* is equivalent to 2·2046 (or about 2½) Lbs. Avoirdupois.

TABLE XXXVIII.—UNITED STATES OF AMERICA.

(Compiled from the Annual Reports of the Foreign Commerce and Navigation of the United States.)

IMPORTS.

COUNTRIES from which Imported.	CATTLE.			SHEEP.		
	1899.*	1900.*	1901.*	1899.*	1900.*	1901.*
	No.	*No.*	*No.*	*No.*	*No.*	*No.*
UNITED KINGDOM	343	309	336	696	375	357
FRANCE	..	..	..	..	..	25
GERMANY	..	..	6	..	..	..
CANADA	118,457	104,116	49,780	343,955	371,440	329,731
CHINA	..	..	..	2	..	..
HAWAII	1	1	..	..	..	..
MEXICO	80,951	76,580	95,863	1,254	9,976	1,367
WEST INDIES	..	..	..	4	1	14
AUSTRALASIA	..	..	35	..	..	8
TOTAL	199,752	181,006	146,022	345,911	381,792	331,488

EXPORTS.

COUNTRIES to which Exported.	CATTLE.			SHEEP.			SWINE.		
	1899.*	1900.*	1901.*	1899.*	1900.*	1901.*	1899.*	1900.*	1901.*
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
BELGIUM	..	..	230	..	..	440	..	..	..
FRANCE	..	..	..	..	..	..	98	..	..
GERMANY	..	500	46	..	..	..	..	..	..
ITALY	..	..	..	..	..	..	..	10	..
NETHERLANDS	..	..	345	..	..	..	..	..	..
PORTUGAL	..	..	..	..	..	..	..	2	..
RUSSIA	..	..	..	..	..	..	12	..	..
UNITED KINGDOM	308,128	302,105	376,380	98,080	73,126	219,426	20	2	..
AFRICA	74	2	3	115	..	51	..	2	3
ARGENTINA	10	..	..	4	25	..	..	..	..
AUSTRALASIA	..	..	2	55	99	82	..	..	4
BERMUDA	1,617	1,669	1,576	1,883	2,248	2,570	20	24	61
BRAZIL	..	7	948	..	5	2	24	..	2
CANADA	3,709	5,233	13,333	34,782	43,535	69,669	1,363	977	1,427
CENTRAL AMERICAN STATES ..	52	15	25	11	13	10	8	4	39
CHINA	1	..	..	..	..	..	..	..	..
COLOMBIA	209	..	6	..	..	3	8	3	10
ECUADOR	2	..	..	..	..	..	2	..	..
GUIANA, BRITISH	..	..	..	1,176	1,080	949	..	..	1
" FRENCH AND DUTCH	..	..	1	..	..	3	6	..	..
HAWAII	208	75	..	149	..	..	6,139	2,699	..
HONDURAS, BRITISH	7	..	159	25	..	60	10	..	5
HONG KONG	6	..	..	..	..	..	..	..	..
JAPAN	28	1	6	..	..	..	..	35	..
MEXICO	2,391	3,761	2,008	3,235	3,011	2,713	7,396	4,777	2,904
VENEZUELA	2	1	6	..	..	..	2	..	..
WEST INDIES, BRITISH	244	177	141	1,762	1,375	1,478	9	1	4
" " OTHER	72,802	83,650	63,404	2,009	1,256	467	17,914	42,644	17,855
OTHER COUNTRIES	..	..	..	..	..	2	..	..	3
TOTAL	389,490	397,286	459,218	143,286	125,772	297,925	33,031	51,180	22,318

* Fiscal Years ending 30th June.

BOARD OF AGRICULTURE.
(INTELLIGENCE DIVISION.)

ANNUAL REPORT

OF

PROCEEDINGS

UNDER

THE SALE OF FOOD AND DRUGS ACTS, 1875 TO 1899,
THE MERCHANDISE MARKS ACTS, 1887 TO 1894,
THE FERTILISERS AND FEEDING STUFFS ACT, 1893,
AND
THE BOARD OF AGRICULTURE ACT, 1889
(SECTION 2, SUB-SECTION 3),

For the Year 1902.

Presented to both Houses of Parliament by Command of His Majesty.

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TABLE OF CONTENTS.

Page.

Report to the Secretary 5

Sale of Food and Drugs Acts, 1875 to 1899 5

Merchandise Marks Acts, 1887 to 1894 9

Fertilisers and Feeding Stuffs Act, 1893 10

Miscellaneous Powers under Section 2 of the Board of Agriculture Act, 1889 16

Colorado Beetle at Tilbury 16

Departmental Committee on Forestry 16

Consulates and Vice-Consulates abroad furnished with Lists of Addresses of British Stock Breeders 17

Special Commissioner sent to South Africa 17

Inquiry into Dutch Brined Vegetable Industry 17

Inquiries into Complaints of Excessive Railway Rates... ... 17

Carriage of Rams in Crates 18

Inquiries as to alleged preferential railway rates for imported produce 18

Railway Rates on Carriage of Milk in Scotland 19

Aggregation of Small Consignments for conveyance by rail ... 19

Unsuitability of Railway Milk Churns as Measures 19

Appointment of Assistant for Marketing and Transport Inquiries 20

Babcock Milk Test 20

Experiments in the Cultivation of Maize as a Fodder Crop ... 20

Grazing of Stock in Orchards sprayed with Poisonous Solutions 20

Journal of the Board of Agriculture 21

Leaflets 21

Inquiries relating to insects and other pests 22

APPENDICES.

I. Regulations issued under the Sale of Food and Drugs Acts, 1875 to 1899 23

II. Statement showing the number of samples of butter, cheese, milk and other articles submitted for analysis in England and Wales in each year from 1890 to 1902 inclusive 24

1250 Wt 415 6/03 D & S 8 14555

Page

III. Statement showing the number of samples of milk and butter reported as having been examined in 1899, 1900 and 1901 by the public analyst of each Local Authority, under the Sale of Food and Drugs Acts, in England and Wales 25

IV. Statement showing the number of samples of milk and butter reported as having been examined in the nine months ended September 30, 1900, and in each of the years ended September 30, 1901 and 1902, respectively, by the public analyst of each Local Authority, under the Sale of Food and Drugs Acts, in Scotland 35

V. On the Nature of Butter-fat and on the Causes affecting its Character (by Dr. T. E. Thorpe, C.B., F.R.S.) 44

VI. Statement showing the prosecutions instituted by the Board of Agriculture under the Merchandise Marks Act, 1887, and the Merchandise Marks (Prosecutions) Act, 1894, during the year 1902 58

VII. Circular with regard to prosecutions under the Merchandise Marks (Prosecutions) Act, 1894 64

VIII. Statement showing the number of analyses made under the Fertilisers and Feeding Stuffs Act, 1893, in each of the Counties and County Boroughs from which analyses were reported in 1902 and 1901 66

IX. Statement showing the counties in which local representatives of the District Agricultural Analysts have been appointed for the purpose of taking samples under the Fertilisers and Feeding Stuffs Act, 1893, and the fees payable for an analysis under the Act, and for the services of the analyst's representative respectively 69

X. List of District Agricultural Analysts approved by the Board under the Fertilisers and Feeding Stuffs Act, 1893 ... — 73

XI. Copy of Correspondence with the Board of Trade and with the Hull and District Fruit Buyers' Association with regard to alleged Preferential Rates charged by Railway Companies on the carriage of Fruit and Vegetables from the Continent, *viâ* Hull, to certain inland towns in this country 80

XII. Copy of Correspondence between the Board of Agriculture and the Central Association of Dairy Farmers with regard to the stamping of railway milk churns for the purposes of the Weights and Measures Acts 83

XIII. Testing of Babcock Apparatus 85

XIV. Publications of the Board of Agriculture 86

PROCEEDINGS OF THE BOARD OF AGRICULTURE (INTELLIGENCE DIVISION)

UNDER

The Sale of Food and Drugs Acts, 1875 to 1899, the Merchandise Marks Acts, 1887 to 1894, the Fertilisers and Feeding Stuffs Act, 1893, and under Section 2 (Sub-section 3) of the Board of Agriculture Act, 1889.

REPORT TO THE SECRETARY OF THE BOARD OF AGRICULTURE.

SIR,

I beg to submit the Report of the Intelligence Division of the Board on its work during the year 1902.

Sale of Food and Drugs Acts, 1875 to 1899.

The Inspectors of the Board have continued to keep closely in touch with the officers responsible for the execution of the Sale of Food and Drugs Acts in the districts of the various Local Authorities under these Acts.

Administration of the Acts by local authorities.

In the large majority of districts the administration of the Acts is such as to afford reasonable security for the purity of the food supply, and for the detection of offences. The number of samples taken is apparently sufficient for the present needs of such districts, and as the sampling officers habitually employ private persons to purchase for them the articles which are to be submitted to the public analyst, it may be presumed that these articles fairly represent, as a rule, the goods that are being supplied to the public. But there are still some authorities who have failed to make provision for the analysis of a sufficient number of samples. In some cases this is apparently due to mistaken notions of economy; in others it is said to be accounted for by the predominance on certain borough councils of traders who are not disposed to facilitate the strict enforcement of the Acts.

Methods of procuring samples.

In certain districts, principally counties, the methods of sampling are still capable of improvement. It is obvious that in order to test the quality of articles of food sold to the public, it must generally be necessary that purchases should be made by some person who appears to the trader to be an ordinary customer. This principle is generally admitted, but the practice of employing agents to purchase samples for sampling officers is by no means universally adopted. It is said to be difficult in some localities to obtain the services of a suitable agent, and it is found that the sampling officers themselves are not always willing to resort to what may be called detective methods. But it is important that these obstacles to effective sampling should be overcome, for it is clear that any trader who is deliberately contravening the Act can generally evade detection when an officer purchases samples in person, and the traders most likely to be proceeded against by the authorities of districts where samples are taken in this way, are those who commit offences through ignorance, and, being innocent of any intention to defraud, take no precautions to protect themselves.

Purchase of test samples by women and children.

It is the practice of certain Local Authorities to cause a number of samples under the Sale of Food and Drugs Acts to be taken in their districts without any of the formalities required by the Acts. Women or children are sent to purchase such samples. The object of taking samples in this way is to discover which traders, if any, are guilty of fraudulent practices. When one of these samples is found to be adulterated further samples are taken of the same article from the same shop with the usual formalities and with a view to the institution of proceedings.

This system has several advantages. It affords an effective means of testing the purity of the food supplied by the traders to their ordinary customers, as the buyers, not being burdened with unfamiliar responsibilities, make the purchases in a natural manner, whereas the agents employed by inspectors who are taking samples under the Acts frequently put the trader on his guard by their nervous and self-conscious behaviour.

It is sometimes difficult to obtain the services of a sufficient number of buyers who will make purchases for an inspector with the prospect of being compelled to appear afterwards as witnesses in prosecutions. The services of such buyers can be reserved for the occasions when samples are to be purchased at suspected shops. Persons can always, without difficulty, be found to make the informal purchases. The system of informal purchases increases the chances of detecting habitual fraud, and at the same time diminishes the risk of the conviction of innocent persons who may contravene the Act by accident. It also saves unnecessary offence to honest shop-keepers whose chief objection to the taking of samples is that the inspector takes up their time and counter space for the division of samples and the sealing of packets, while his action excites curiosity on the part of the customers.

Examination of margarine registers.

In the course of the year over 800 registers of wholesale dealers in margarine and margarine cheese were examined by the Board's Inspectors. The registers have, as a rule, been found to be kept in a satisfactory manner in accordance with the requirements of Section 7 of the Act of 1899.

Registration of wholesale dealers in margarine.

Notifications were received by the Board from 63 Local Authorities of the registration of 207 separate premises of wholesale dealers in, or manufacturers of, margarine and margarine cheese.

According to the returns furnished to the Board to the end of December, 1902, the total number of premises of wholesale dealers in, and of manufacturers of, margarine and margarine cheese registered in Great Britain since the Act came into force is 2,930.

Sale of Butter Regulations.

In exercise of the powers conferred upon them by Section 4 of the Sale of Food and Drugs Act, 1899, the Board issued on the 22nd April, 1902, Regulations relating to the sale of butter in Great Britain, which came into force on the 15th May, 1902.

These Regulations provide that in cases in which the proportion of water in a sample of butter exceeds 16 per cent., it shall be presumed for the purposes of the Sale of Food and Drugs Acts, 1875 to 1899, until the contrary is proved, that the butter is not genuine by reason of the excessive amount of water therein. A copy of the Regulations will be found in Appendix I.

The Sale of Butter Regulations, 1902, have been placed on sale as No. 355 of the Statutory Rules and Orders, 1902. Copies of this Rule, which can be obtained from Messrs. Eyre & Spottiswoode, East Harding Street, London, E.C., are admissible as evidence in Courts of Law, under the Documentary Evidence Acts, 1868 to 1895, without any formal certificate by the Board as to their accuracy.

Samples taken at the ports.

In the course of the year 1902, 2,216 samples of imported articles of food were taken at the ports of entry, under Section 1 of the Sale of Food and Drugs Act, 1899, and analysed at the Government Laboratory. These included 1,834 samples of butter, 225 of cheese, 145 of milk, and 12 of cream. Two samples, both milk, were reported against. In the case of one of them legal proceedings were taken against the importer, and a conviction was obtained. In the other case satisfactory evidence was furnished to the Commissioners of Customs that the importer had no legal "intent" to defraud, and proceedings were waived on payment of a fine of 40s. which was imposed under the Customs Consolidation Act.

In 1901 the number of samples of butter, cheese, milk and cream taken at the ports was 2,142, of which 11 were reported against: in 1900, 1,590 samples were taken, of which 26 were reported to be adulterated.

Number of samples analysed in England and Wales.

According to the reports furnished to the Local Government Board for England and Wales, the total number of samples of articles of food submitted for analysis under the Sale of Food and Drugs Acts, by Local Authorities in England and Wales in 1901, was 67,841, as compared with 62,858 in 1900, and 53,056

Number of samples analysed in England and Wales.

in 1899. Of the 67,841 samples analysed during 1901, all but 354 were procured by officers of Local Authorities.

The number of samples of milk examined in 1901 was 26,143 or 2,920 in excess of the total for 1900. Of these 2,988, or 11·2 per cent., were found to be adulterated, as compared with 10·8 per cent. in 1900. Legal proceedings were instituted in respect of 1,839 of the samples of milk reported against in 1901, and 1,527 convictions were obtained.

Of butter the number of samples examined in 1901 amounted to 11,938, or 1,564 more than the total recorded for 1900. Adulteration was detected in 1,224 cases, or 10·3 per cent. of the samples examined, as compared with 7·8 per cent. in the previous year. Prosecutions were undertaken in respect of 734 samples, and penalties were imposed in 584 cases. There were also 104 penalties imposed for offences under the Acts relating to margarine.

The number of samples of cheese examined in 1901 was 1,652, or 42 less than in 1900. Only 18, or 1·1 per cent. of the total, were reported against, as compared with 3·1 per cent. in the previous year.

There were 202 samples of condensed milk submitted for analysis in 1901, of which eight were condemned. Among other articles examined in that year were 530 samples of bread, 587 of flour, and 1,374 of lard, and the number of samples reported against in each case was 4, 2, and 5 respectively.

The Board are indebted to the Local Government Board for a preliminary statement of the results of the examination of samples of milk, butter and cheese, submitted for analysis, under the Sale of Food and Drugs Acts, in England and Wales in 1902. The number of samples of milk examined was 29,452, of which 3,427 were found to be adulterated; of butter 13,387 samples were analysed and 865 found adulterated; and of cheese 1,797 samples were examined and 34 found adulterated.

The analysts' reports with regard to these articles for the past three years show the following results of the examinations of the samples submitted for analysis.

Year.	Milk.			Butter.			Cheese.		
	Examined.	Adulterated.	Percentage Adulterated.	Examined.	Adulterated.	Percentage Adulterated.	Examined.	Adulterated.	Percentage Adulterated.
	No.	No.	%	No.	No.	%	No.	No.	%
1900	23,223	2,497	10·8	10,374	807	7·8	1,694	52	3·1
1901	26,143	2,938	11·2	11,938	1,224	10·3	1,652	18	1·1
1902	29,452	3,427	11·6	13,387	865	6·5	1,797	34	1·9

A statement is given in Appendix II. showing the number of samples of butter, cheese, milk, and other articles submitted for analysis in England and Wales, and the number found adulterated, in each year from 1891 to 1902 inclusive.

A statement is also given, Appendix III., showing the number of samples of milk and butter reported as having been submitted for examination in the years 1899, 1900 and 1901, under the Sale of Food and Drugs Acts, by each Local Authority in England and Wales.

Number of samples analysed in Scotland.

The reports transmitted to the Local Government Board for Scotland show that during the year ended 30th September, 1902, the number of articles examined under the Sale of Food and Drugs Acts, by public analysts, on behalf of Scotch Local Authorities, was 6,761, and, on behalf of private persons, 188, as compared with 5,493 and 197 respectively in the corresponding period of 1900–1901. The total number of samples examined in the year ended 30th September last was 6,949, or 1,259 in excess of the 5,690 examined in the preceding 12 months.

Of milk 3,027 samples were examined on behalf of Local Authorities in Scotland in the year ending 30th September last, of which 491, or 16·2 per cent., were reported to be adulterated; of 1,068 samples of butter, 58, or 5·4 per cent., were adulterated, and of 141 samples of cheese, 4, or 2·8 per cent., were adulterated. In the previous year the numbers of samples of these articles submitted by Local Authorities for examination were:—milk, 2,031, of which 372, or 18·3 per cent., were adulterated; butter, 653, of which 59, or 9·0 per cent., were adulterated; and cheese, 131, of which 9, or 6·9 per cent., were adulterated.

The number of samples of milk and butter reported as having been submitted for examination by each Local Authority in Scotland in the nine months ended September 30th, 1900, and in the years ended with the same date in 1901 and 1902 is shown in Appendix IV.

Nature of Butter-fat.

Appendix V. contains a statement prepared by Dr. T. E. Thorpe, C.B., F.R.S., Principal Chemist of the Government Laboratories, on "the Nature of Butter-fat and the Causes affecting its Character."

The Merchandise Marks Acts, 1887 to 1894.

Proceedings in cases of fraudulent sale of hams.

In 1902 proceedings were instituted by the Board in 21 cases of sales of hams under a false trade description as to the origin of the goods. The evidence in each case was furnished by the Bacon Curers' Association of Great Britain and Ireland. In connection with these proceedings 38 persons were prosecuted, and 30 were convicted; seven persons were acquitted; and in one case, in which the principal and assistant were charged, the assistant could not be traced.

Particulars of these prosecutions will be found in Appendix VI.

Evidence required by Board's Regulations.

Applications were made to the Board to take action in several other instances of alleged sales of articles of food under false trade descriptions, but in none of these cases was the necessary evidence forthcoming. In accordance with the Regulations made in 1895 by the Board, with the concurrence of the Lord Chancellor, applications to the Board to exercise the powers conferred upon them by the Merchandise Marks (Prosecutions) Act, 1894, must be supported by a statement, showing the nature and circumstances of the case, and sufficient to enable the Board to form an opinion whether the case relates to agricultural or horticultural produce, and affects the general interests of the country, or of a section of the community, or of a trade. A statement is also required of the facts capable of proof, with the names and addresses of the witnesses available to prove such facts.

The text of these Regulations is embodied in a circular issued by the Board in February, 1895, which is reproduced in Appendix VII. Copies of this circular may be obtained on application to the Secretary, Board of Agriculture, 4, Whitehall Place, London, S.W.

Fertilisers and Feeding Stuffs Act, 1893.

Fertilisers and Feeding Stuffs Act, 1893. Analyses made in 1902.

The returns received from District Agricultural Analysts under the Fertilisers and Feeding Stuffs Act, 1893, show that in 1902 samples were analysed in 65 counties and boroughs of Great Britain, as against 60 in 1901, and 58 in 1900. There was a considerable increase in the total number of samples analysed which amounted to 1,300, as compared with 1,068 in 1901 and 974 in 1900. The extent to which the Act was put into operation in England, Wales, and Scotland, respectively, is shown below.

—	No. of Counties or Boroughs in which Analyses were made.		Number of Analyses.					
			1902.			1901.		
	1902.	1901.	Fertilisers.	Feeding Stuffs.	Total.	Fertilisers.	Feeding Stuffs.	Total.
England : Counties	35	30	348	316	664	284	193	477
,, Boroughs	2	2	30	27	57	32	22	54
Wales : Counties ...	8	9	130	95	225	81	99	180
Scotland : Counties	20	19	271	83	354	274	83	357
Great Britain	65	60	779	521	1,300	671	397	1,068

It will be noticed that the increase in the number of samples took place in England and Wales; in Scotland there was a slight decline. For several years the returns of the number of analyses made annually under the Act in Scotland have been almost stationary.

Tables giving the details for each county will be found in Appendix VIII.

Action taken by local authorities.

During the past year an inquiry has been made by the Board's Inspectors as to the steps taken by Local Authorities to give effect to the Fertilisers and Feeding Stuffs Act, and a considerable amount of information has been obtained bearing on the questions whether further action is desirable to protect purchasers of fertilisers and feeding stuffs against fraud; what are the causes to which the comparative neglect of the advantages offered by this Act is due; and whether anything can be done to make the Act more effective.

The arrangements made by the County Councils have been found to vary greatly, both in respect to the fee payable by the purchaser who desires to have a sample analysed by the District Analyst, and in the extent of the assistance given by the authorities in carrying out the formalities required by the Act, and by the Regulations of the Board, in taking samples under the Act. From the statement in Appendix IX. it will be seen that in several districts only a nominal fee is charged for analysis, and that in some cases analyses can be obtained free of cost to the purchaser. It will also be seen that many County Councils have appointed local representatives of the analyst to perform the act of sampling when requested to do so by a purchaser, and that this service is given gratis or charged for at a very low rate.

The Local Authorities of some districts do not take any steps to prevent purchasers from sending to the analyst samples which have not been taken with the formalities required by the Act and Regulations, while others do not allow such samples to be analysed. This difference is important as the necessity for giving notice to the seller, and for carrying out the Regulations as to sampling, often tends to deter purchasers from taking advantage of the Act.

Generally the Local Authorities have not done more, to procure the taking of samples under the Act, than hold out inducements to purchasers in the shape of cheap analyses, but in some few districts a more active policy has been adopted.

In Aberdeenshire, for example, repeated efforts have been made to enlist the co-operation of local agricultural societies. In Wilts a number of analyst's representatives have been appointed, and are paid *5s. 0d.* for each sample they take. In Glamorganshire the Superintendents of Police, who act as analyst's representatives, have been instructed to make purchases of fertilisers and feeding stuffs with a view to taking samples of such purchases under the Act.

Reasons why further action is required.

The question whether further action is desirable to protect purchasers of fertilisers and feeding stuffs against fraud must, however, in view of the information obtained, be answered in the affirmative.

In certain localities the whole trade in these articles is said to be in the hands of a few firms of good standing, and in such localities there is presumably no great need for improvement in the administration of the Act. But as a rule the sources of supply are numerous, and, in some cases, not above suspicion.

The poorer and less educated purchasers do not take samples. The sale of inferior or adulterated manures and feeding stuffs to such persons, therefore, affords a safe and obvious opportunity of making illicit profits. And, judging from what takes place in other trades, it seems unlikely that such an opportunity is altogether neglected.

This probability is supported by the statements of many of the better class of merchants and manufacturers who complain of the unfair competition to which they are subjected.

It is true that the District Analysts do not often find anything wrong with the samples submitted to them, but these samples are almost all sent in by land agents or large farmers who are dealing only with reliable firms, and the fact that such samples are up to the guarantee and of good quality cannot be taken to indicate that the trade generally is in a perfectly satisfactory condition.

Effect of private analyses.

Something is done by private analyses to keep such frauds in check. Almost all the principal agricultural societies in the country have retained the services of an agricultural chemist to make analyses for members at low fees. There are also numerous associations of farmers for co-operative purchase and analysis of manures.

But private analyses cannot have much effect beyond the protection of the individual or the members of the association for whom the analyses are made. The fraudulent seller can rely on coming to an arrangement with the purchaser with regard to any deficiency disclosed by such analyses, should detection involve the risk of any serious exposure.

Causes of rarity of sampling.

The rarity of sampling under the Act is probably due to one or more of the following reasons :—

1. Difficulty of carrying out regulations.

(1.) Difficulty in carrying out the regulations as to sampling. The taking of samples under the Act, involving, as it does, the possibility of criminal proceedings against the seller, has necessarily been made a precise and formal matter, and, to persons unaccustomed to official work, the formalities required as a protection to the seller against unfair sampling naturally appear complicated.

2. Expense.

(2.) Expense. It is difficult to estimate the extent to which the fees payable by purchasers act as a deterrent to sampling under the Act.

Causes of rarity of sampling.
2. Expense.

The general experience of Local Authorities is that no complaints are ever made as to the expense of sampling. But this may be due to the fact that very few purchasers take action involving such expense.

The number of samples taken in districts where small fees, or no fees, are charged is not much greater than the number taken in districts where appreciable fees are charged. But there are so many circumstances bearing on the question why fewer samples are taken in some districts than in others that the evidence of the returns on the point under consideration is not very definite.

Many farmers object to pay fees for analyses under this Act, not so much on account of the expense, as because they feel that there is an injustice in charging fees in connection with the detection of fraud in the sale to them of fertilisers and feeding stuffs, while the sampling and analysis of milk and butter sold by them is carried out free of cost to the purchaser.

3. Relations between buyers and sellers.

(3.) The relations existing between the buyers and sellers of manures and feeding stuffs tend strongly to prevent sampling under the Act. The taking of a sample in accordance with the regulations, preceded as it is by the giving of notice, accompanied by legal forms, and attended by the possibility of proceedings of a criminal character, is often regarded by sellers as a threatening and insulting action. Many farmers are under pecuniary obligations to the merchants and dare not move in the matter. Others, again, are unwilling to disturb the friendship which may have existed between themselves and the merchant for many years. The trade in manures and feeding stuffs is often described as "a very friendly trade." The evidence of many persons intimately acquainted with the subject goes to show that there is a great deal of truth in this description. And, to the extent to which friendship enters into the business relations of the farmer and the manure or cake merchant, to that extent it is impossible for the farmer, on his own initiative, to take samples under the Act, for if a farmer spontaneously takes such a sample the necessary inference is that he suspects the merchant of fraud or error.

4. Apathy.

(4.) Apathy. Probably the chief cause of the neglect of this Act is what may be called natural apathy. The detection of fraud in the fertilisers and feeding stuffs trade is everybody's business and therefore nobody's business. There is no reason why one farmer should take up the work of putting the Act in operation any more than another. There is no inducement to take samples under the Act except that a reliable analysis can be obtained at a cheap rate, and this inducement is generally counterbalanced by the trouble involved in carrying out the formalities, and the risk of incurring the odium which often falls to the lot of those who voluntarily concern themselves with the detection of offences.

Farmers of the class who would be likely to have analyses made under the Act generally belong to one of the agricultural societies above mentioned which provide facilities for analysis at low rates, and they are not unnaturally inclined to consult their own immediate interests by having analyses made privately instead of assisting Local Authorities to check fraud by having samples taken under the Act.

Procedure contemplated by the Act.

The procedure which is apparently contemplated by the Act is that such facilities should be offered for analysis as will induce purchasers to submit a number of samples for analysis sufficient to enable the Local Authorities to detect any fraud that may be carried on in their districts. But experience has shown that it is very doubtful if the object of the Act can be attained by merely following the procedure indicated by the Act.

Informal taking of samples.

A decision has lately been given by a Divisional Court of the High Court of Justice, in the case of Korten v. The West Sussex County Council, which deserves the careful consideration of all interested in the administration of this Act.

It has been widely assumed that a purchaser is debarred from enforcing the remedies conferred by the Act, unless he complies with the sampling regulations made by the Board of Agriculture and obtains a certificate of analysis from the District Agricultural Analyst. As such a certificate would seem to be evidence only as against the person, often a mere agent, who sold direct to the person obtaining the analysis, there appeared to be a difficulty in proceeding under the Act against the wholesale dealer or manufacturer, though he might be the party really responsible for the misdescription of the goods.

The decision above referred to lays down that even where the samples have not been taken in accordance with the prescribed regulations, and no certificate of the District Agricultural Analyst has been obtained, proceedings can be taken by a County Council in respect of an offence under the Act by a wholesale dealer in respect of a false invoice furnished by him to a middleman.

Where samples are to be taken in such a way that in any legal proceedings they may be accepted without question as being fair samples of the bulk, the procedure prescribed by the regulations is not too elaborate, and an opportunity of being present at the sampling is thus given to the seller; but if any farmer prefers to sample in his own way, and without notice to the seller, it will, on the authority of this decision, be open to the County Council, and possibly to the farmer if he so desires, to take proceedings under the Act, subject to the risk of the fairness of the samples being called in question, and to the necessity of calling the analyst as a witness, instead of merely tendering his certificate as evidence of the analysis.

By offering free analysis, and allowing purchasers to submit samples without giving notice to the seller, a Local Authority might hope to bring about the taking of a considerable number of samples. But the poorer and less educated purchasers, who are certain to be the principal sufferers by any fraud that may exist, will not take samples, no matter what facilities are offered.

Local Authorities might appoint Analyst's representatives to take samples.

There is no doubt that in many districts some advantage might be gained by administering the Act on the following lines :—

Officers of the Local Authority might be appointed as analysts' representatives, where this has not already been done, and these representatives, instead of waiting to be called upon to take a sample, might take the initiative in the matter themselves. Information as to the character of the trade in manures and feeding stuffs of any given district is not difficult to obtain, and with such information in view the representatives could decide as to what articles ought to be sampled. And there should be no difficulty in finding among the purchasers of such articles some who are independent and public-spirited enough to go through the form of requesting the analyst's representative to take a sample, and to give him the information and assistance necessary to enable him to do so. It would be necessary in cases where the sample is taken in this way at the request of an official of the Local Authority, that the purchaser should be relieved as far as possible of all expense.

Under a system of this kind three of the principal obstacles to sampling under the Act, *i.e.*, difficulty of carrying out the regulations, expense, and apathy, would be entirely removed.

With regard to the difficulties arising out of the relations between the purchasers and seller, it may be admitted that a purchaser who is in debt to the seller is not in a position to help the officers of the Local Authority in any action that may be against the interests of the seller. But, so far as concerns the risk of hurting the feelings of the merchant, the farmer who allows a sample to be taken at the instance of an official is in a very different position from one who takes a sample on his own account, for the latter must be presumed to have taken the sample because he suspected error or fraud, while the former may have allowed the sample to be taken in order to facilitate the working of the scheme of the Local Authority.

No doubt difficulties would be met by analysts' representatives in obtaining samples, but these difficulties would not be greater than those successfully negotiated by inspectors who take samples of food and drugs in course of delivery under Section 14 of the Sale of Food and Drugs Act of 1899.

The sellers would benefit in one way by a more general employment of analysts' representatives, as the formalities intended to protect sellers from the risk of unfair sampling would be invariably properly carried out. They would receive from the representatives the usual three days' notice of the intended sampling, but if they were able to trust the representative as an impartial and efficient sampler they would be saved the trouble of attending.

A comparatively small number of samples collected in this way would do a great deal towards making the Act effective. The additional expense to Local Authorities involved in the adoption of this system would not be considerable.

The Board have suggested to several Local Authorities the desirability of administering the Act on the lines above indicated, and their suggestions have in most instances been favourably received.

Districts in which analysts' representatives have been appointed.

A statement is appended showing the counties in which the Local Authorities have appointed local representatives of the District Agricultural Analyst for the purpose of taking samples of fertilisers and feeding stuffs. Particulars are also given of the fees payable by purchasers for an analysis and for the services of the analyst's representative respectively. (Appendix IX.)

Parchment coffee-husk as an adulterant of feeding stuffs.

A circular letter was sent to District Agricultural Analysts in June last calling their attention to the fact that there is a large importation into this country of parchment coffee-husk which is believed to be employed for the adulteration of bran, bean-meal and other feeding stuffs for cattle. The Principal Chemist of the Government Laboratory is of opinion that there should be no difficulty in ascertaining the presence of this material in bran by means of the microscope, and that the characteristic structure of the husk will also facilitate its detection when ground and mixed with bean-meal.

District Agricultural Analysts.

A list of the names and addresses of the District Agricultural Analysts in Great Britain will be found in Appendix X.

Miscellaneous Powers under Sub-section 3 of Section 2 of the Board of Agriculture Act, 1889.

Colorado Beetle.

The land at Tilbury Docks upon which the Colorado Beetle made its appearance in August, 1901, was kept under inspection in 1902. A few beetles were discovered in May and June, but these were immediately destroyed, and no further specimens were found in the course of the year. Arrangements have been made to keep the land under observation during 1903.

Departmental Committee on Forestry.

A Departmental Committee was appointed by the Board in February, 1902, to inquire into and report as to the present position and future prospects of forestry, and the planting and management of woodlands in Great Britain, and to consider whether any measures might with advantage be taken, either by the provision of further educational facilities or otherwise, for their promotion and encouragement. The report of the Committee has been presented to both Houses of Parliament, and is issued as a parliamentary publication. [Cd. 1319. Price 2*d*.]

The Board have made arrangements with the Foreign Office whereby lists of the names and addresses of British breeders of horses, cattle, sheep, and pigs, will in future be kept at certain consular offices on the continent, in the United States, and in South America, for the information of persons who may desire to purchase stock for breeding purposes. The lists furnished to the Board by 47 Breeders' Associations have been distributed to His Majesty's Consulates and Vice-Consulates at the following places:—Aarhus, Antwerp, Belgrade, Berlin, Brussels, Bucharest, Budapest, Christiania, Copenhagen, Gothenburg, The Hague, Hamburg, Lisbon, Moscow, Paris, Rome, St. Petersburg, Stockholm, Vienna, Baltimore, Boston, Chicago, Galveston, Kansas, New Orleans, New York, San Francisco, St. Louis, St. Paul, Buenos Ayres, Monte Video, Rio de Janeiro, Rosario, and Valparaiso.

Consulates and Vice-Consulates furnished with addresses of British stock-breeders.

Arrangements were made with the Board of Trade that the special commissioner appointed by that Department to inquire as to the openings for British trade in South Africa, should include British agricultural produce within the scope of his inquiry, particularly with reference to the prospects of developing a trade in British pedigree stock for breeding purposes, and in seeds, potatoes, hops, preserved fruits, and vegetables.

Special Commissioner sent to South Africa.

A special inquiry was made into the conditions under which the export trade in brined vegetables is carried on in the Netherlands. These investigations were undertaken in consequence of representations addressed to the Board by the Biggleswade Trades and Agricultural Association as to the serious effects of the Dutch competition on the brined vegetable industry in this country. In the course of this inquiry the principal market-gardening districts in North and South Holland were visited by Mr. Crawford, the head of the Intelligence Branch of the Department, who was accompanied by a representative of the Biggleswade Association, and an inspection was made of the processes employed in a number of brining factories in these provinces. At the same time particulars were obtained of the working of the Dutch co-operative associations for the sale of market-garden produce, and a visit was also made to one of the winter schools for horticulture and market-gardening. The results of these investigations were presented to both Houses of Parliament and have been issued as a Parliamentary publication. [Cd. 1368. Price 8*d*.]

Inqui. [illegible] Dutch brined vegetable industry.

Numerous complaints have been addressed to the Board with regard to railway rates on agricultural produce. Inquiries have been made by the Board's Inspectors in each case in which specific examples were given of apparent disproportionate charges, and

Inquiries into complaints of excessive railway rates.

representations have been made to the railway companies concerned in those instances where such action was deemed desirable.

Carriage of rams in crates.

At the request of the National Sheep Breeders' Association arrangements were made with the Board of Trade to invite representatives of the Association, and of the principal railway companies, to a conference, to consider whether any reduction could be effected in the charges for the carriage of rams in crates by passenger train. The mileage rate for rams in crates is higher than that charged for boars, ewes, and wethers similarly carried, but there does not appear to be any justification for this differential treatment inasmuch as rams in crates are not generally heavier or more difficult to handle than boars or ewes. As a result of this conference, at which officers of the Board of Agriculture were present, the question is to receive the further consideration of the General Managers of the railway companies represented at the conference.

Inquiries as to alleged preferential railway rates for imported produce.

Representations have been made to the Board with regard to alleged preferential rates charged by railway companies for the carriage of fruit and vegetables from the Continent to certain inland towns in this country. The Board believe that it is not generally known that the amounts charged by railway companies for the carriage of goods by sea and by rail can be ascertained separately. A copy of correspondence with the Board of Trade, and with the Hull and District Fruit Buyers' Association, with regard to this question is published in Appendix XI. It will be seen from the reply by the Board of Trade that railway companies which carry merchandise partly by land and partly by sea are bound to specify, in the rate books kept at the ports of the United Kingdom which they use, the proportion of any through rate appropriated to conveyance by sea, and that these books can be inspected by any person during all reasonable hours without the payment of a fee.

In a memorial received from the County Council of Perth, attention was called to the inequalities in the railway rates for the carriage of grain, potatoes, hay, and lime between certain stations in Scotland, and to the disparity in the cost of conveyance by rail of imported and home grown meat respectively from Glasgow to London. Complaint was also made of the high charges for the carriage of fruit by rail from Blairgowrie to certain English towns, as compared with the cost of carrying fruit to the same towns from the continent. The Board's Inspectors are in communication with the officials of the railway companies concerned with regard to the several points raised in the Memorial.

Complaints of a similar character were also addressed to the Board by the Scottish Chamber of Agriculture in respect of apparently preferential rates quoted by railway companies for the carriage of foreign meat from Glasgow and Liverpool to London, as compared with the rates charged for home grown meat conveyed from Haddington. The Chamber further directed attention to the differences between the railway charges for the conveyance of grain and hay from inland stations to certain centres, and those quoted for the carriage of the same kind of produce from the ports. Inquiries are being made into these cases, and a preliminary report has been submitted to the Scottish Chamber of Agriculture containing the explanations offered by the railway companies with regard to the grain rates. The Board are in communication with the Board of Trade as to the further action to be taken in the case of the rates for meat.

Railway rates on carriage of milk in Scotland.

A resolution was received from the Federation of Dairy Farmers' Associations of Scotland requesting the Board to use their influence to procure a re-classification of the rates for the carriage of milk on railways in Scotland, in order that the charges might be arranged on a scale similar to that in force on English railways. After inquiry, the Board requested the Board of Trade to communicate with the principal Scottish railway companies in the matter, under the provision of Section 5 of the Railway and Canal Act, 1888. The railway companies in their replies pointed out that while the scale in force on English lines is lower than the Scottish companies' rates for short distances, it is higher for distances over 100 miles.

Aggregation of small consignments for conveyance by rail.

In connection with the complaints received from individuals on the subject of excessive railway charges for the carriage of agricultural produce, it has been found that rates for small consignments from a rural station are sometimes contrasted with those quoted for five-ton lots or truck loads from centres where there is considerable traffic. In some of these cases the Board have suggested that an endeavour should be made by the persons consigning goods to the local station to aggregate their consignments, in order to bring them within the scale of weights for which lower rates are quoted. If arrangements could be made by collecting the goods on certain days, or by the delivery of the produce at the station by the consignors themselves before a certain hour on the same day, it is probable that the aggregated lots would be carried at a lower ton-rate already in operation for large consignments, or, if no such rate existed, a special reduction might fairly be asked for. The position of the Board in intervening in cases in which lower rates are desired, would be materially strengthened if they were able to approach the railway companies in the interests of a body of consignors who could undertake collectively to provide a reasonable amount of traffic at regular intervals. It is hoped, also, that the companies may be willing to assist in the organisation of co-operative schemes for the cheaper distribution of farm produce by rail if they find any disposition on the part of the consignors to participate earnestly in the movement.

Unsuitability of railway milk churns as measures.

A Resolution was sent to the Board, in April last, by the Central Association of Dairy Farmers, urging that railway milk churns should be exempted from the regulations imposed by the Weights and Measures Acts, inasmuch as the rough usage these churns received made it impossible for them to remain accurate measures. The Board, in their reply, concurred in the view as to the unsuitability of milk churns as measures, but they pointed out that in cases where churns are so used the provision of the Weights and Measures Acts must obviously apply. The Board suggested that the difficulty referred to in the Resolution might be met by invoicing milk conveyed in railway churns by "measured weight" and deducting the tare for the churn. It is hoped that Dairy Farmers' Associations will take steps to bring to the notice of the milk trade generally the advantages of this system of invoicing milk. A copy of the correspondence dealing with this subject will be found in Appendix XII.

Appointment of Assistant for Marketing and Transit Inquiries.

In view of the increasing number of applications made to the Board for advice and assistance with regard to questions of railway rates, market regulations, and similar subjects relating to the distribution of farm produce, it has been found necessary to increase the staff of the Intelligence Branch by the appointment of an Assistant for Marketing and Transit Inquiries.

Babcock milk test.

The regulations drawn up by the Committee of the National Physical Laboratory for the verification of the apparatus used in the Babcock method of testing milk are given in Appendix XIII.

Experiments in the cultivation of maize.

With the object of gaining further information as to the prospects of an extension of the cultivation of maize as a fodder crop in this country, and also of testing a few of the chief varieties of seed, the Board made arrangements last year to carry out experiments in growing this fodder in the warmer districts of England and Wales, under the supervision of the Agricultural Colleges.

The Board undertook to supply a sufficient quantity of seed for tests to be conducted at centres in counties associated with the University College of Wales, Aberystwyth; the University College, Reading; the Midland Agricultural and Dairy Institute; Cambridge University; and the South Eastern Agricultural College, Wye. At Wye a stave silo was erected in order that this means of conserving maize might be tested. The conclusion drawn from these experiments, full details of which were published in the Board's Journal for March, 1903, is that where the conditions of soil and climate are favourable maize will give a large yield of useful fodder. No doubt a warmer and drier season than 1902 would have produced better results; in fact, it is when the conditions are unfavourable to the growth of ordinary green crops that maize grows best and proves most useful. Great care should be taken to select a variety with a good reputation, and failure is certain to follow any neglect to thoroughly protect the germinating seed against the ravages of birds, especially rooks.

Grazing of stock in orchards sprayed with poisonous solutions.

In connection with the extended use of poisonous preparations for the destruction of injurious insects and fungi it was considered desirable to gain some definite information with regard to the possible effects of poisonous solutions, applied to fruit trees, on live stock that may graze the herbage beneath such trees. The Board accordingly made arrangements with the South-Eastern Agricultural College, Wye, to carry out an experiment to test the effect of pasturing sheep in an orchard which had been sprayed with an arsenical solution. The results of the experiment, which were published in the Journal of the Board of Agriculture for September, 1902, indicated that there is no danger in keeping stock on land where trees have been sprayed or washed with arsenites.

Journal of the Board of Agriculture.

The special articles published in the Journal of the Board of Agriculture during the past year have included the following:— The Purchase of Artificial Manures; The Purchase of Feeding Stuffs; Compounding of Rations for Farm Stock; Farmyard Manure; The Seeding of Grain; Cultivation of Lucerne; Milking and Butter Test Trials; Haymaking; Black Dry Rot in Swedes; Larch and Spruce Fir Canker; Farmers' Co-Operative Societies; The House Sparrow; and Wool and Shoddy.

Reviews and notices of the following agricultural and other experiments have also appeared in the Journal:—The Growth of Hops; Feeding Dairy Cows; Bullock Feeding; Sheep Feeding; Manuring of Potatoes; Potato Planting; Manuring of Turnips; The Preservation of Eggs; and The use of Cod Liver Oil as a Substitute for Cream in Calf Rearing.

Leaflets.

Seven new leaflets were issued in 1902, and circulated in the manner shown in previous reports. The new leaflets (Nos. 71-77) deal with the Colorado Beetle, the Purchase of Artificial Manures, the Cultivation of Maize for Fodder, the Purchase of Feeding Stuffs, Root-knot Disease in Cucumbers and Tomatoes, Cucumber and Melon Leaf Blotch, and Finger-and-toe in Turnips.

The leaflet on the Colorado Beetle was prepared and issued with the object of facilitating recognition of the beetle in the event of its spreading from the potato patches at Tilbury where it was found in 1901. This object having been attained, the leaflet has now been withdrawn from circulation.

In the autumn of 1902 an endeavour was made to get into closer touch with farmers and others in Great Britain, and bring directly to their notice the fact that leaflets on agricultural subjects could be had by applying to the Board. A circular letter was accordingly prepared and issued to the Chairmen of Parish Councils throughout Great Britain, offering to supply them with leaflets for distribution, and to regularly send copies of new leaflets, as issued, to any persons who desired to receive them.

The total number of leaflets issued in 1902 was approximately 398,900. The last four of the new leaflets enumerated above were only issued towards the end of the year, and they had not been circulated to all the persons on the Board's list by December 31st, so that the total of 398,900 is exclusive of these four new leaflets. No special distribution of a single leaflet appeared to be called for in 1902, whereas, in 1901, 400,000 out of a total of 587,400 were issued of the leaflet dealing with swine-fever. The increase over the remainder (187,400) is mainly attributable to applications received in response to the circular mentioned above as having been issued to Parish Councils.

The leaflet dealing with the Purchase of Artificial Manures was translated into Welsh.

Inquiries with regard to insect and fungoid pests.

Numerous applications were received asking for the identification of insect and fungoid pests. The arrangements made with the British Museum (Natural History Department), and the Royal Botanic Gardens, Kew, for furnishing technical advice, have enabled the Board to give the information required and to suggest remedies in all the cases. In many instances the notes on these pests, supplied by the Board's technical advisers, have been published in the Journal. In a case of an outbreak of a fungus disease of young fruit trees which occurred in Notts an expert was sent down from Kew to investigate and report on the disease.

A list of the publications of the Board is printed in Appendix XIV.

I have the honour to be, Sir,
Your obedient Servant,
WM. SOMERVILLE

Board of Agriculture,
4, Whitehall Place,
London, S.W.

May 25th, 1903.

APPENDIX I.

Regulations issued in 1902 by the Board of Agriculture under the Sale of Food and Drugs Act, 1899.

BOARD OF AGRICULTURE RULES. [DATED 22ND APRIL, 1902.]

SALE OF BUTTER REGULATIONS, 1902.

THE Board of Agriculture, in exercise of the powers conferred on them by section 4 of the Sale of Food and Drugs Act, 1899, do hereby make the following Regulations :—

1. Where the proportion of water in a sample of butter exceeds 16 per cent. it shall be presumed for the purposes of the Sale of Food and Drugs Acts, 1875 to 1899, until the contrary is proved, that the butter is not genuine by reason of the excessive amount of water therein.

2. These Regulations extend to Great Britain.

3. These Regulations shall come into operation on the Fifteenth day of May, One thousand nine hundred and two.

4. These Regulations may be cited as the Sale of Butter Regulations 1902.

In witness whereof the Board of Agriculture have hereunto set their Official Seal this Twenty-second day of April, One thousand nine hundred and two.

T. H. ELLIOTT,
Secretary.

(L.S.)

APPENDIX II.

STATEMENT, BASED ON INFORMATION CONTAINED IN THE REPORTS OF THE LOCAL GOVERNMENT BOARD, SHOWING THE NUMBER OF SAMPLES OF BUTTER, CHEESE, MILK AND OTHER ARTICLES SUBMITTED FOR ANALYSIS, AND THE NUMBER AND PERCENTAGE FOUND ADULTERATED, IN ENGLAND AND WALES IN EACH OF THE YEARS, 1890–1902, INCLUSIVE.

Year.	Butter.			Cheese.			Milk.			Other Articles.			Total.		
	Examined	Adulterated.	Percentage Adulterated.	Examined.	Adulterated.	Percentage Adulterated.	Examined.	Adulterated.	Percentage Adulterated.	Examined.	Adulterated.	Percentage Adulterated.	Examined.	Adulterated.	Percentage Adulterated.
	No.	No.	%	No.	No.	%	No.	No.	%	No.	No.	%	No.	No.	%
1890	2,743	316	11·5	180	8	6·2	11,967	1,530	12·8	12,625	1,215	9·6	27,465	3,069	11·2
1891	3,558	551	15·5	143	5	3·5	12,151	1,633	13·4	13,176	1,351	10·3	29,028	3,540	12·2
1892	4,743	725	15·3	†	†	†	13,633	1,818	13·3	14,071	1,466	10·4	32,447	4,009	12·4
1893	5,784	794	13·7	330	12	3·6	15,543	2,310	14·9	15,576	1,677	10·8	37,233	4,793	12·9
1894	6,419	667	10·4	421	13	4·3	16,305	1,858	11·4	16,371	1,507	9·2	39,516	4,060	10·3
1895	7,186	590	8·2	597	19	3·2	18,307	2,030	11·1	17,872	1,454	8·1	43,962	4,093	9·3
1896	8,256	725	8·8	558	5	0·9	18,795	2,091	11·1	17,946	1,381	7·7	45,555	4,202	9·2
1897	8,164	841	10·3	630	16	2·5	18,896	1,967	10·4	19,166	1,559	8·1	46,856	4,383	9·4
1898	9,375	998	10·6	554	5	0·9	20,315	2,011	9·9	19,311	1,305	6·8	49,555	4,319	8·7
1899	10,478	1,018	9·7	642	6	0·9	21,964	2,314	10·5	19,972	1,632	8·2	53,066	4,970	9·4
1900	10,374	807	7·8	1,694	52	3·1	23,223	2,497	10·8	27,567	2,147	7·8	62,858	5,503	8·8
1901	11,938	1,224	10·3	1,652	18	1·1	26,143	2,938	11·2	28,108	1,809	6·4	67,941	5,989	8·8
1902	13,387	865	6·5	1,797	34	1·9	29,452	3,427	11·6	—	—	—	—	—	—

† Included in "Other Articles."

APPENDIX III.

STATEMENT SHOWING THE NUMBER OF SAMPLES OF MILK AND BUTTER REPORTED AS HAVING BEEN EXAMINED IN 1899, 1900, AND 1901 BY THE PUBLIC ANALYST OF EACH LOCAL AUTHORITY, UNDER THE SALE OF FOOD AND DRUGS ACTS IN ENGLAND AND WALES.

—	Milk.						Butter.					
	1899.*		1900.*		1901.		1899.*		1900.*		1901.	
	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.
METROPOLITAN BOROUGHS.*	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Battersea	226	23	179	33	232	35	86	18	56	2	106	18
Bermondsey	205	55	264	43	250	22	41	4	65	0	121	21
Bethnal Green	73	31	95	32	219	29	66	29	53	13	97	20
Camberwell	202	33	243	31	289	30	173	22	180	26	180	11
Chelsea	103	5	92	8	201	8	26	3	18	2	17	1
Deptford	..†	..†	[illegible]	[illegible]	229	[illegible]	..†	..†	41	14	[illegible]	[illegible]
Finsbury	204	56	239	26	252	56	139	20	73	7	122	33
Fulham	128	22	96	22	189	[illegible]	124	20	106	6	114	12
Greenwich	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hackney	394	103	291	68	306	102	161	28	141	32	171	[illegible]
Hammersmith	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11	[illegible]	[illegible]
Hampstead	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Holborn	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	[illegible]	[illegible]
Islington	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Kensington	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4	[illegible]	[illegible]
Lambeth	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Lewisham	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
London, City	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Paddington	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Poplar	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
St. Marylebone	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
St. Pancras	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Shoreditch	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Southwark	400	78	457	25	412	[illegible]	305	14	300	[illegible]	341	[illegible]
Stepney	357	80	309	50	360	45	95	47	97	41	313	[illegible]
Stoke Newington ..	[illegible]	5	44	1	41	4	[illegible]	0	6	0	31	0
Wandsworth	263	21	195	25	233	32	201	22	201	8	181	11
Westminster, City ..	504	54	313	27	501	23	136	6	121	[illegible]	274	[illegible]
Woolwich	219	9	236	15	317	[illegible]	40	23	[illegible]	7	113	4
TOTAL* ..	5,686	907	5,767	606	7,967	1,012	3,030	471	3,004	269	3,705	412
BEDFORD.												
County Jurisdiction ..	127	20	79	11	72	8	30	8	25	0	20	4
Boroughs:												
Bedford	4	0	8	0	11	5	..	—	2	1	6	1
Luton	39	3	35	2	39	6	31	8	4	0	6	0
TOTAL ..	170	32	110	13	125	14	35	8	29	1	42	5
BERKS.												
County Jurisdiction ..	7	3	36	8	32	3	23	1	21	1	36	2
Boroughs:												
Newbury	8	0	8	2	8	0	—	—	—	—	5	0
New Windsor ..	4	2	5	0	6	0	4	0	1	0	2	1
Reading	32	1	56	11	29	7	21	2	1	0	35	6
TOTAL ..	51	5	103	19	75	10	45	3	23	0	72	9

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* The figures shown against the Metropolitan Boroughs for 1899 and 1900 represent, as far as possible, the totals for the former Local Authorities whose districts were included in the areas of the various Boroughs created by the London Government Act, 1899, which came into force in November, 1900. The figures are not, however, strictly comparable with those for 1901, owing to the extensive changes which have, in some instances, been made in the local boundaries.

† The area comprising Deptford was, prior to November, 1900, included in the old vestry of Greenwich.

STATEMENT SHOWING THE NUMBER OF SAMPLES OF MILK AND BUTTER, &c.—*continued.*

	Milk.						Butter.					
	1899.		1900.		1901.		1899.		1900.		1901.	
	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.
BUCKINGHAM.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
County jurisdiction ..	37	3	58	1	57	10	16	0	5	0	12	4
Borough :												
Chipping Wycombe	11	0	3	0	12	0	8	0	9	0	15	2
TOTAL ..	51	3	61	1	69	10	24	0	14	0	27	6
CAMBRIDGE.												
County jurisdiction ..	17	1	49	5	69	9	4	0	8	0	7	0
Isle of Ely	9	0	14	0	32	2	2	0	6	0	8	0
Borough :												
Cambridge . ..	21	3	35	8	66	5	3	0	10	0	3	0
TOTAL ..	47	4	98	13	167	16	9	0	24	0	18	0
CHESTER.												
County jurisdiction ..	333	17	271	20	358	20	256	8	227	7	248	10
Boroughs :												
Birkenhead	31	5	58	9	79	14	24	0	33	3	50	9
Chester	11	2	9	2	20	0	9	1	6	0	5	0
Congleton	..	..	..	..	7	1	..	..	..	..	..	..
Hyde	* ..	* ..	26	3	30	3	* ..	* ..	17	0	30	0
Macclesfield.. ..	19	6	39	4	18	2	9	0	3	0	..	..
Stalybridge	3	0	6	0	6	0	3	1	5	0	6	1
Stockport	35	3	27	5	79	12	31	4	8	1	14	2
TOTAL ..	421	27	436	43	597	52	331	14	299	11	363	22
CORNWALL.												
County jurisdiction ..	46	7	71	17	49	4	15	0	7	1	17	1
Boroughs :												
Penzance	..	..	11	2	17	4	..	..	2	0	4	0
Truro	2	0	8	0	3	0	3	0	5	1	1	0
TOTAL ..	48	7	90	19	69	8	18	0	14	2	22	1
CUMBERLAND.												
County jurisdiction ..	67	4	65	4	44	3	12	0	12	0	10	0
Boroughs :												
Carlisle	14	0	6	2	11	1	..	..	8	0	12	0
TOTAL ..	81	4	71	6	55	4	12	0	20	0	22	0
DERBY.												
County jurisdiction ..	67	10	77	9	65	6	229	8	345	2	180	8
Boroughs :												
Chesterfield ..	27	1	23	0	31	4	3	0	3	0	11	0
Derby	20	0	41	2	12	1	7	0	2	0	11	1
Glossop	..	..	..	..	11	0	..	..	9	0	12	1
TOTAL ..	114	11	141	11	119	11	239	8	359	2	214	10

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* Hyde became a Local Authority under the Sale of Food and Drugs Acts in 1900, the Acts having been administered in the Borough by the County prior to that year.

Statement showing the Number of Samples of Milk and Butter, &c.—continued.

—	Milk.						Butter.					
	1899.		1900.		1901.		1899.		1900.		1901.	
	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.
Devon.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
County jurisdiction ..	95	6	109	8	150	7	22	1	87	0	34	3
Boroughs:												
Barnstaple	—	—	8	0	13	0	—	—	—	—	1	0
Devonport	28	0	30	11	24	6	30	0	26	4	22	0
Exeter	36	1	51	6	20	3	10	0	18	0	0	3
Plymouth	88	2	63	10	61	4	10	1	54	5	19	0
Tiverton	—	—	4	0	6	0	0	1	2	0	2	1
Total ..	247	9	263	36	290	21	64	3	145	5	87	7
Dorset.												
County jurisdiction ..	22	2	30	3	19	1	32	0	30	1	39	1
Boroughs:												
Poole	—	—	28	2	27	1	—	—	12	0	15	0
Weymouth	7	0	21	0	17	3	2	0	1	0	3	1
Total ..	29	2	78	4	63	5	30	0	55	1	54	2
Durham.												
County jurisdiction ..	146	5	144	20	225	22	120	2	78	4	84	3
Boroughs:												
Durham	6	0	6	1	6	1	3	0	2	0	6	3
Gateshead	56	3	52	6	61	11	24	3	36	0	6	0
Hartlepool	11	0	16	1	9	0	3	0	3	0	3	0
South Shields	35	3	55	2	49	6	4	1	7	0	26	1
Sunderland	82	5	105	11	85	22	36	4	8	0	21	1
West Hartlepool ..	26	1	36	2	18	1	6	1	8	0	12	2
Total ..	346	18	385	42	448	73	204	11	170	4	162	9
Essex.												
County jurisdiction ..	328	41	846	71	690	50	302	40	271	21	220	41
Boroughs:												
Colchester	21	1	27	2	18	6	4	0	9	0	34	1
West Ham	294	40	438	88	541	56	92	12	219	21	240	36
Total ..	850	82	1,306	164	1,164	126	398	52	500	48	581	78
Gloucester.												
County jurisdiction ..	111	6	70	11	25	5	96	0	160	2	75	5
Boroughs:												
Bristol	264	19	233	32	272	22	305	19	380	16	375	16
Gloucester	29	1	4	1	37	2	—	—	12	0	19	6
Total ..	406	26	307	44	304	29	403	19	560	18	480	27
Hereford.												
County jurisdiction ..	4	2	15	3	21	2	8	0	6	3	9	1
Borough:												
Hereford	21	0	26	0	17	1	13	0	8	0	10	0
Total ..	25	2	41	3	38	3	21	0	14	3	19	1

STATEMENT SHOWING THE NUMBER OF SAMPLES OF MILK AND BUTTER, &c.—*continued.*

—	Milk.						Butter.					
	1899.		1900.		1901.		1899.		1900.		1901.	
	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.
HERTFORD.	No.	No	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
County jurisdiction ..	71	9	102	7	80	6	30	8	65	2	63	8
Borough :												
St. Albans	21	0	36	0	18	0	..	..	3	0	3	0
TOTAL ..	92	9	138	7	98	6	30	8	68	2	66	8
HUNTINGDON.												
County jurisdiction (No Borough.) ..	32	5	27	0	22	0	14	0	17	0	9	1
KENT.												
County jurisdiction ..	200	60	220	53	297	68	243	4	220	3	261	13
Boroughs :												
Canterbury	18	3	28	1	28	5	4	0	5	0	19	9
Dover	33	4	11	1	21	6	4	0	16	0	5	0
Folkestone	29	3	44	10	67	15	5	0	19	2	13	3
Gravesend	16	1	19	6	18	4	1	0	2	0	2	1
Maidstone	20	1	35	5	24	2	11	1	10	0	9	1
Margate	23	2	40	9	41	7	7	0	..	..	11	1
Ramsgate	24	5	27	4	31	10	7	0	16	1	12	4
Rochester	3	1	..	..	6	3	3	0	..	..	4	0
Tunbridge Wells ..	..	..	30	3	22	2	5	0	17	0	13	0
TOTAL ..	370	80	452	92	555	122	290	5	305	6	349	32
LANCASTER.												
County jurisdiction ..	523	57	362	46	600	46	330	85	206	61	197	34
Boroughs :												
Accrington	12	0	24	1	18	3	..	..	3	2	17	0
Ashton-under-Lyne	10	1	25	0	42	5	1	0	20	0	6	2
Bacup..	10	0	8	0	7	0	4	0	2	1	3	0
Barrow-in-Furness	14	2	12	0	19	2	13	1	12	2	14	0
Blackburn	21	2	32	4	20	2	12	1	17	1	30	4
Blackpool	23	8	21	8	28	2	7	0	8	0	25	3
Bolton..	46	12	132	11	241	48	57	17	41	12	25	8
Bootle	72	10	73	12	86	13	20	4	28	1	35	2
Burnley	32	1	68	6	78	5	17	0	41	2	108	5
Bury	22	1	22	0	23	3	11	1	19	6	14	1
Clitheroe	3	0	3	0	8	0	3	0	2	0	6	0
Lancaster	6	0	12	0	8	0	3	0	10	0	7	0
Liverpool	905	119	940	121	906	100	33	3	39	4	94	18
Manchester	1,145	30	960	22	909	31	165	22	149	10	177	22
Oldham	50	1	72	4	109	8	27	3	29	5	34	4
Preston	43	3	53	8	88	10	49	4	21	3	39	6
Rochdale	78	3	64	1	85	8	25	5	23	4	10	2
St. Helens	59	0	36	0	51	4	49	5	43	1	24	0
Salford	338	8	298	16	329	22	391	19	330	4	303	6
Southport	23	0	41	1	50	2	11	0	20	0	19	0
Warrington	34	0	62	1	50	3	24	1	36	2	60	0
Wigan..	7	0	16	0	8	0	50	11	40	4	41	2
TOTAL ..	3,488	258	3,365	262	3,844	317	1,353	182	1,130	117	1,348	119

STATEMENT SHOWING THE NUMBER OF SAMPLES OF MILK AND BUTTER, &c.—*continued.*

—	Milk.						Butter.					
	1899.		1900.		1901.		1899.		1900.		1901.	
	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.
LEICESTER.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
County jurisdiction ..	[illegible]	4	[illegible]	3	[illegible]	5	[illegible]	[illegible]	29	5	32	[illegible]
Borough: Leicester	[illegible]	5	[illegible]	4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TOTAL ..	[illegible]	9	[illegible]	7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5	[illegible]	[illegible]
LINCOLN.												
County jurisdiction: Parts of Holland ..	[illegible]	[illegible]	19	[illegible]	18	2	[illegible]	[illegible]	[illegible]	1	20	[illegible]
" Kesteven..	[illegible]	[illegible]	4	1	11	[illegible]	4	[illegible]	[illegible]	[illegible]	15	[illegible]
" Lindsey ..	16	1	16	1	15	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1
Boroughs: Boston	7	[illegible]	7	1	[illegible]	[illegible]	..	..	[illegible]	1	[illegible]	[illegible]
Grantham	[illegible]	[illegible]	12	[illegible]	5	[illegible]	4	[illegible]	..	..	[illegible]	[illegible]
Grimsby	[illegible]	1	[illegible]	[illegible]	74	[illegible]	3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Lincoln	[illegible]	[illegible]	[illegible]	1	21	1	..	..	[illegible]	[illegible]	[illegible]	[illegible]
Louth	..	..	5	0	..	..	..	..	..	..	[illegible]	[illegible]
TOTAL ..	[illegible]	2	[illegible]	13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2	[illegible]	5
MIDDLESEX (Extra Metropolitan).												
County jurisdiction (No Borough.) ..	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	77	[illegible]	[illegible]	[illegible]	[illegible]	474	[illegible]
MONMOUTH.												
County jurisdiction ..	[illegible]	8	[illegible]	13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3	[illegible]	[illegible]
Borough: Newport	[illegible]	4	[illegible]	9	[illegible]	[illegible]	[illegible]	1	19	[illegible]	[illegible]	[illegible]
TOTAL ..	[illegible]	12	[illegible]	22	[illegible]	[illegible]	124	7	115	3	[illegible]	[illegible]
NORFOLK.												
County jurisdiction ..	[illegible]	[illegible]	43	[illegible]	[illegible]	7	13	[illegible]	[illegible]	[illegible]	7	[illegible]
Boroughs: King's Lynn.. ..	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2	1	4	[illegible]	[illegible]	[illegible]
Norwich	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	14	2	[illegible]	[illegible]
Yarmouth, Great ..	[illegible]	3	[illegible]	8	[illegible]	11	..	..	6	1	[illegible]	[illegible]
TOTAL ..	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5	[illegible]	3	[illegible]	3
NORTHAMPTON.												
County jurisdiction ..	114	[illegible]	[illegible]	[illegible]	[illegible]	8	[illegible]	1	[illegible]	[illegible]	[illegible]	2
Soke of Peterborough	3	[illegible]	3	[illegible]	3	[illegible]	2	[illegible]	2	[illegible]	2	[illegible]
Boroughs: Northampton ..	[illegible]	8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9
Peterborough ..	[illegible]	[illegible]	6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6	[illegible]
TOTAL ..	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	[illegible]	2	[illegible]	[illegible]

STATEMENT SHOWING THE NUMBER OF SAMPLES OF MILK AND BUTTER, &c.—*continued.*

—	Milk.						Butter.					
	1899.		1900.		1901.		1899.		1900.		1901.	
	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.
NORTHUMBERLAND.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
County jurisdiction ..	49	1	34	3	28	0	12	0	12	0	26	3
Boroughs:												
Berwick-upon-Tweed.	6	0	3	0	5	2	1	0	1	0	3	0
Newcastle-on-Tyne	68	3	62	4	62	15	51	12	52	0	35	2
Tynemouth	..	..	24	3	..	..	..	..	..	..	6	0
TOTAL ..	123	4	123	10	95	17	64	12	65	0	70	5
NOTTINGHAM.												
County jurisdiction ..	66	6	71	3	51	7	48	2	55	2	42	3
Boroughs:												
Newark	12	0	7	2	17	1	3	0	1	0	3	0
Nottingham.. ..	176	47	78	20	95	16	24	0	42	1	72	2
TOTAL ..	254	53	156	25	163	24	75	2	98	3	117	5
OXFORD.												
County jurisdiction ..	84	13	8	0	29	5	66	7	45	0	23	1
Boroughs:												
Banbury	3	0	3	0	..	..	..	..	3	0	..	..
Oxford	20	1	8	3	13	4	..	..	19	3	13	1
TOTAL ..	107	14	19	3	42	9	66	7	67	3	36	2
RUTLAND.												
County jurisdiction .. (No Borough.)	3	0	..	..	10	0	..	..	..	..	..	..
SALOP.												
County jurisdiction ..	7	0	24	3	12	1	9	0	..	..	7	0
Boroughs:												
Shrewsbury ..	20	5	11	0	22	1	2	0	4	0	1	0
Wenlock	2	0	8	1	..	..	..	..	..	..	..	..
TOTAL ..	29	5	43	4	34	2	11	0	4	0	8	0
SOMERSET.												
County jurisdiction ..	143	6	96	5	121	1	87	1	45	0	78	2
Boroughs:												
Bath	106	8	100	8	76	1	25	0	34	4	43	9
Bridgwater	6	0	..	..	7	0	..	..	13	0	1	0
TOTAL .	255	14	196	13	204	2	112	1	92	4	122	11

STATEMENT SHOWING THE NUMBER OF SAMPLES OF MILK AND BUTTER, &c.—*continued.*

—	Milk.						Butter.					
	1899.		1900.		1901.		1899.		1900.		1901.	
	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.
	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
SOUTHAMPTON.												
County jurisdiction ..	[illegible]	20	[illegible]	15	[illegible]	13	135	2	112	6	104	6
Isle of Wight	23	1	20	2	20	2	11	0	16	0	20	0
Boroughs:												
Bournemouth ..	*	*	9	0	58	11	*	*	8	3	34	31
Portsmouth ..	108	32	123	27	144	29	32	9	33	2	48	4
Ryde	2	0	..	..	17	6	6	0	..	..	..	..
Southampton ..	126	27	122	13	136	18	60	1	69	14	26	2
Winchester	15	0	4	1	12	3	2	0	2	0	6	0
TOTAL ..	535	[illegible]	530	[illegible]	[illegible]	73	[illegible]	11	[illegible]	24	[illegible]	28
STAFFORD.												
County jurisdiction ..	511	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	327	37	365	[illegible]	[illegible]	29
Boroughs:												
Burton-upon-Trent	†	†	†	†	26	3	†	†	†	†	7	2
Hanley	17	1	40	1	36	2	13	0	27	0	35	1
Newcastle-under-Lyme.	14	0	31	0	51	0	6	0	17	0	10	2
Walsall	39	5	47	6	43	4	18	1	18	1	30	1
West Bromwich ..	57	5	62	7	73	3	36	1	38	0	27	0
Wolverhampton ..	59	10	63	13	63	3	17	1	30	2	30	12
TOTAL ..	691	41	837	64	[illegible]	[illegible]	407	39	495	33	400	46
SUFFOLK.												
County jurisdiction:												
Eastern Division ..	21	2	73	7	[illegible]	19	22	0	45	0	30	0
Western Division ..	32	2	13	0	51	1	28	0	47	0	36	0
Boroughs:												
Bury St. Edmunds	1	0	4	2	..	..	..	..	8	0	1	0
Ipswich	12	3	21	5	38	1	0	0	3	0	..	..
TOTAL ..	66	7	111	14	190	21	50	0	103	0	67	0
SURREY.												
County jurisdiction ..	281	42	360	45	411	50	325	19	192	10	190	21
Boroughs:												
Croydon	162	13	132	15	156	29	24	1	22	0	49	2
Guildford	..	..	17	8	..	..	8	0	8	0	1	0
Reigate	14	3	15	5	19	5	..	..	7	0	14	0
TOTAL ..	457	58	524	73	586	84	357	20	229	10	[illegible]	23

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* Bournemouth became a Local Authority under the Sale of Food and Drugs Acts in 1900, the Acts having been administered in the Borough by the County prior to that year.

† Burton-upon-Trent became a Local Authority under the Sale of Food and Drugs Acts in 1901, the Acts having been administered in the Borough by the County prior to that year.

STATEMENT SHOWING THE NUMBER OF SAMPLES OF MILK AND BUTTER, &c.—*continued.*

—	Milk.						Butter.					
	1899.		1900.		1901.		1899.		1900.		1901.	
	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.
SUSSEX.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
County jurisdiction:												
Eastern Division ..	46	5	57	6	172	24	17	0	24	1	20	1
Western Division ..	22	2	28	4	51	4	..	..	7	0	18	2
Boroughs:												
Brighton	56	9	256	40	268	81	6	0	66	12	66	9
Eastbourne	35	6	46	5	50	10	17	0	16	0	15	6
Hastings	69	1	94	6	69	4	31	4	30	0	23	8
Hove	40	1	38	7	57	14	19	0	13	0	24	9
TOTAL ..	268	24	519	68	667	137	90	4	156	13	166	35
WARWICK.												
County jurisdiction ..	274	17	138	0	168	6	156	9	95	2	94	10
Boroughs:												
Birmingham ..	442	106	359	77	453	77	313	98	300	129	359	131
Coventry	60	8	67	6	73	5	23	0	24	0	47	3
Leamington ..	22	3	20	8	24	0	..	..	7	0	12	4
Warwick	5	0	4	0	7	0	2	0	7	0	8	0
TOTAL ..	803	134	588	91	725	88	494	107	440	131	520	148
WESTMORLAND.												
County jurisdiction ..	10	1	11	0	2	0	5	0	2	0	2	0
Borough:												
Kendal	..	..	7	1	12	0	..	..	3	0	2	0
TOTAL ..	10	1	18	1	14	0	5	0	5	0	4	0
WILTS.												
County jurisdiction ..	80	10	84	12	86	11	46	0	42	12	62	21
Borough:												
Salisbury	14	1	12	0	12	0	9	0	6	0	15	0
TOTAL ..	94	11	96	12	98	11	55	0	48	12	77	21
WORCESTER.												
County jurisdiction ..	58	6	80	4	106	3	56	1	85	6	174	19
Boroughs:												
Dudley	21	1	17	0	21	0	12	1	23	5	1	0
Kidderminster ..	25	4	22	0	21	0	4	0	8	0	8	0
Worcester	36	5	28	1	29	1	22	1	21	1	25	4
TOTAL ..	140	16	147	5	177	4	94	3	137	12	208	23
YORK—EAST RIDING.												
County jurisdiction ..	22	2	12	0	..	..	18	1	12	0	6	0
Boroughs:												
Beverley	4	1	3	0	6	0	1	0	1	0	1	0
Kingston-on-Hull..	160	11	152	10	168	18	16	0	23	0	30	4
York	27	1	54	4	51	0	4	0	15	0	23	1
TOTAL ..	213	15	221	14	225	18	39	1	51	0	60	5

STATEMENT SHOWING THE NUMBER OF SAMPLES OF MILK AND BUTTER, &c.—*continued.*

—	Milk.						Butter.					
	1899.		1900.		1901.		1899.		1900.		1901.	
	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.
YORK—NORTH RIDING.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
County jurisdiction ..	38	1	35	0	47	4	29	1	16	0	26	2
Boroughs:												
Middlesbrough ..	39	3	21	4	37	4	2	0	24	4	45	1
Scarborough ..	11	0	15	0	9	0	3	0	5	4	8	0
TOTAL ..	88	4	71	4	93	8	34	1	45	8	79	3
YORK—WEST RIDING.												
County jurisdiction ..	952	22	948	43	[illegible]	57	159	5	471	11	460	13
Boroughs:												
Barnsley	*	*	30	1	38	2	*	*	4	0	..	..
Bradford	171	5	180	9	106	6	50	16	52	10	54	15
Dewsbury	[illegible]	[illegible]	19	0	12	2	0	0	2	0	8	0
Doncaster	15	[illegible]	18	1	18	1	..	..	7	0	6	0
Halifax	[illegible]	1	112	3	102	3	6	0	24	2	10	2
Huddersfield ..	174	10	90	5	156	2	14	3	20	2	12	1
Leeds	365	25	467	50	390	36	20	14	78	26	40	18
Rotherham	90	1	50	2	41	4	3	0	4	0	9	1
Sheffield	144	29	379	38	392	22	23	0	92	6	45	0
Wakefield	19	4	25	6	50	7	7	0	18	0	18	0
TOTAL ..	1,891	103	2,147	156	2,135	172	287	47	697	60	667	57
WALES.												
ANGLESEY.												
County jurisdiction ..	..	..	10	1	..	..	6	1	3	0	7	0
BRECKNOCK.												
County jurisdiction ..	4	0	17	1	16	1	..	..	3	0	3	0
CARDIGAN.												
County jurisdiction ..	29	2	18	2	24	0	..	..	2	0	1	0
CARMARTHEN.												
County jurisdiction ..	18	1	24	0	22	4	4	0	11	0	10	0
Borough:												
Carmarthen.. ..	7	1	10	0	7	0	..	..	—	—	..	..
TOTAL ..	25	2	34	0	29	4	4	0	11	0	10	0
CARNARVON.												
County jurisdiction ..	15	1	45	5	46	6	5	1	38	2	26	4
DENBIGH.												
County jurisdiction ..	38	2	67	5	85	2	15	1	36	1	40	6

* Barnsley became a Local Authority under the Sale of Food and Drugs Acts in 1900, the Acts having been administered in the Borough by the County prior to that year.

STATEMENT SHOWING THE NUMBER OF SAMPLES OF MILK AND BUTTER, &c.—continued.

—	Milk.						Butter.					
	1899.		1900.		1901.		1899.		1900.		1901.	
	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.
FLINT.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
County jurisdiction ..	71	8	83	3	45	13	47	5	38	4	22	9
GLAMORGAN.												
County jurisdiction ..	306	23	337	23	333	29	104	1	119	6	92	1
Boroughs:												
Cardiff	309	5	401	23	326	30	67	4	42	0	36	3
Neath	23	8	36	9	21	4	9	0	10	0	6	0
Swansea	136	9	139	5	142	12	21	0	11	0	8	2
TOTAL ..	[illegible]	45	[illegible]	62	[illegible]	[illegible]	200	7	182	6	142	6
MERIONETH.												
County jurisdiction ..	5	1	4	2	2	0	..	..	1	0	1	0
MONTGOMERY.												
County jurisdiction ..	1	0	—	—	1	0	..	..	..	—	1	0
PEMBROKE.												
County jurisdiction ..	6	0	21	5	2	0	..	—	..	—	1	0
RADNOR.												
County jurisdiction ..	..	..	..	—	—	—	—	—	—	—	2	0

APPENDIX IV.

STATEMENT SHOWING THE NUMBER OF SAMPLES OF MILK AND BUTTER REPORTED AS HAVING BEEN EXAMINED IN THE NINE MONTHS ENDED 30TH SEPTEMBER, 1900, AND IN EACH OF THE YEARS ENDED 30TH SEPTEMBER, 1901 AND 1902, BY THE PUBLIC ANALYST OF EACH LOCAL AUTHORITY, UNDER THE SALE OF FOOD AND DRUGS ACTS IN SCOTLAND.

—	Milk.						Butter.					
	Nine months ended 30th September, 1900.		Year ended 30th September,				Nine months ended 30th September, 1900.		Year ended 30th September,			
			1901.		1902.				1901.		1902.	
	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.
ABERDEEN.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
County jurisdiction ..	16	3	8	0	20	2	5	0	13	1	34	1
Burghs:												
Aberdeen	37	4	50	6	79	4	23	0	26	1	93	1
Ballater	..	..	6	1	[illegible]	[illegible]	..	..	2	0	..	..
Ellon	..	..	..	..	[illegible]	[illegible]	..	..	..	..	[illegible]	[illegible]
Fraserburgh ..	[illegible]	1	10	1	[illegible]	[illegible]	..	..	[illegible]	[illegible]	[illegible]	[illegible]
Huntly	[illegible]	[illegible]	1	0	[illegible]	[illegible]	..	..	[illegible]	[illegible]	[illegible]	[illegible]
Inverurie	6	1	1	0	[illegible]	[illegible]	..	..	1	1	[illegible]	[illegible]
Kintore	..	..	[illegible]	[illegible]	[illegible]	[illegible]	..	..	1	0	[illegible]	[illegible]
Old Meldrum ..	..	..	[illegible]	[illegible]	[illegible]	[illegible]	..	..	..	..	..	..
Peterhead	..	..	[illegible]	[illegible]	[illegible]	[illegible]	..	..	[illegible]	[illegible]	[illegible]	[illegible]
Rosehearty	3	0	[illegible]	[illegible]	[illegible]	[illegible]	..	..	[illegible]	[illegible]	[illegible]	[illegible]
Turriff	3	0	1	0	..	..	1	0	..	..	[illegible]	[illegible]
TOTAL ..	96	8	79	4	176	13	29	0	40	8	116	3
ARGYLL.												
County jurisdiction ..	1	0	6	1	60	5	..	..	..	..	2	0
Burghs:												
Campbeltown ..	29	1	6	0	17	0	..	..	1	0	1	0
Dunoon	11	0	21	1	13	1	2	1	2	0	0	0
Inveraray	2	0	..	..	..	..	1	0	..	..	..	..
Lochgilphead ..	..	..	7	0	..	..	..	..	..	..	..	..
Oban	3	2	..	..	..	..	..	..	..	..	..	..
Tobermory	..	..	8	1	7	0	..	..	1	0	..	..
TOTAL ..	40	3	41	3	82	4	3	1	5	1	13	0

STATEMENT SHOWING THE NUMBER OF SAMPLES OF MILK AND BUTTER, &c.—*continued.*

—	Milk.						Butter.					
	Nine months ended 30th September, 1900.		Year ended 30th September,				Nine months ended 30th September, 1900.		Year ended 30th September,			
			1901.		1902.				1901.		1902.	
	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.
LANARK.	No.	No.	No.	No.	No.	No.	No.	No	No.	No.	No.	No.
County jurisdiction ..	11	3	31	6	106	12	31	7	29	5	37	5
Burghs:												
Airdrie	6	2	19	5	19	4	..	..	..	..	3	1
Biggar	..	..	..	..	2	0	..	..	1	0	..	..
Coatbridge	8	2	22	3	56	3	2	0	2	0	27	2
Glasgow	135	43	148	71	153	59	47	14	82	6	125	11
Govan	25	2	55	10	55	4	14	3	15	1	27	1
Hamilton	..	..	4	1	21	2	..	..	6	0	6	0
Kinning Park ..	..	..	8	2	8	2	2	0	2	0	3	1
Lanark	13	1	..	..	5	0	..	..	4	2	..	..
Motherwell ..	..	..	9	0	16	0	..	..	..	..	2	0
Partick	44	9	68	16	99	12	10	3	27	2	32	1
Rutherglen	3	1	6	1	17	2	2	0	1	0	3	1
Wishaw	..	..	9	1	4	0	..	..	..	..	..	..
TOTAL ..	245	63	377	114	560	100	108	27	169	16	265	23
LINLITHGOW.												
County jurisdiction ..	12	0	15	5	27	7	3	0	5	1	11	1
Burghs:												
Armadale	..	..	4	0	6	2	..	..	1	0	1	0
Bathgate	..	..	3	0	10	0	..	..	..	..	3	0
Borrowstounness ..	7	1	7	1	8	3	5	0	..	..	..	..
Linlithgow	1	0	10	1	6	1	2	0	..	..	1	0
Queensferry.. ..	..	..	..	..	5	0	..	..	..	..	2	0
Whitburn	..	..	..	..	3	0	..	..	..	..	2	0
TOTAL ..	20	1	39	7	65	13	10	0	6	1	20	1
MIDLOTHIAN.												
County jurisdiction ..	32	8	46	21	63	36	17	4	15	3	1	1
Burghs:												
Bonnyrigg	..	..	..	..	..	..	..	..	..	..	1	0
Dalkeith	3	3	18	5	3	2	..	..	1	0	3	0
Edinburgh	22	8	69	21	106	47	21	6	29	3	21	3
Lasswade	..	..	2	0	..	..	..	..	1	0	..	..
Leith	10	1	19	9	65	26	..	..	3	0	23	3
Loanhead	..	..	7	3	..	..	..	..	2	1	..	..
Musselburgh ..	..	..	..	..	9	4	..	..	..	..	3	0
Penicuik	..	..	8	2	9	5	..	..	..	..	2	0
TOTAL ..	67	20	169	61	254	120	38	10	51	7	54	6
NAIRN.												
County jurisdiction ..	..	..	1	0	..	..	..	..	1	0	..	..
Burgh:												
Nairn	..	..	..	..	4	0	..	..	1	0	1	0
TOTAL ..	..	..	1	0	4	0	..	..	2	0	1	0

Statement showing the Number of Samples of Milk and Butter, &c.—*continued.*

—	Milk.						Butter.					
	Nine months ended 30th September, 1900.		Year ended 30th September,				Nine months ended 30th September, 1900.		Year ended 30th September,			
			1901.		1902.				1901.		1902.	
	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.
CAITHNESS.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
County jurisdiction ..	..	—	—	—	2	1	..	..	5	1	[illegible]	[illegible]
Burghs:												
Pulteneytown ..	..	—	2	1	—	—	—	..	1	0	—	..
Thurso	..	—	5	2	7	1	..	..	..	..	5	0
Wick	..	—	2	0	[illegible]	0	..	..	1	0	—	—
TOTAL ..	..	..	9	3	19	2	..	..	7	1	18	[illegible]
CLACKMANNAN.												
County jurisdiction ..	6	2	..	..	[illegible]	[illegible]	1	0	3	[illegible]	..	—
Burghs:												
Alloa .. — ..	..	..	..	..	11	1	—	—	..	..	31	2
Alva .. — ..	..	..	4	0	6	1	—	—	..	..	..	—
Dollar — ..	4	0	18	0	17	0	—	—	2	0	..	..
Tillicoultry	..	..	5	0	5	0	—	—	2	0	4	1
TOTAL ..	10	2	27	0	[illegible]	2	1	0	7	0	[illegible]	3
DUMFRIES.												
Joint Committee* ..	3	0	15	1	16	2	3	[illegible]	[illegible]	[illegible]	12	0
DUMBARTON.												
County jurisdiction ..	30	0	96	[illegible]	141	2	29	1	[illegible]	[illegible]	31	1
Burghs:												
Clydebank	6	0	20	2	19	3	4	0	5	0	5	0
Cove and Kilcreggan.	..	..	11	0	..	..	..	—	—	..	..	..
Dumbarton	3	1	[illegible]	1	[illegible]	0	[illegible]	0	7	0	2	0
Helensburgh ..	6	1	5	0	15	0	[illegible]	1	[illegible]	0	6	1
Kirkintilloch ..	..	..	[illegible]	0	[illegible]	0	..	—	—	—	8	1
Milngavie	..	..	1	0	12	3	..	..	5	0	..	..
TOTAL ..	45	2	162	3	200	10	31	2	22	0	41	3
ELGIN.												
County jurisdiction ..	..	..	13	2	8	0	..	—	—	..	6	0
Burghs:												
Burghead	..	..	6	0	..	..	..	—	—	..	..	..
Elgin	4	1	..	..	1	0	..	—	—	..	3	0
Forres..	7	0	..	..	..	..	..	—	—	..	..	..
Grantown-on-Spey	..	..	6	0	..	..	..	—	—	..	..	..
Lossiemouth ..	..	..	..	..	4	0	—	—	—	..	1	0
Rothes	..	..	3	2	..	..	..	—	—	..	..	..
TOTAL ..	11	1	24	4	13	0	..	—	—	..	9	0

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* Includes County of Dumfries and Burghs therein.

STATEMENT SHOWING THE NUMBER OF SAMPLES OF MILK AND BUTTER, &c.—*continued.*

—	Milk.						Butter.					
	Nine months ended 30th September, 1900.		Year ended 30th September,				Nine months ended 30th September, 1900.		Year ended 30th September,			
			1901.		1902.				1901.		1902.	
	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.
ROSS AND CROMARTY.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
County jurisdiction ..	..	..	3	1	15	0	..	..	7	0	19	1
Burghs:												
Cromarty	..	..	..	..	..	..	..	..	..	..	3	0
Dingwall	..	..	..	..	5	0	..	..	..	..	1	0
Fortrose	..	..	..	..	..	..	..	..	..	..	2	0
Invergordon ..	..	..	..	..	2	1	..	..	..	..	4	0
Stornoway	..	..	3	0	1	1	..	..	3	0	1	0
Tain	..	..	..	..	4	0	..	..	1	0	..	..
TOTAL ..	..	..	6	1	27	2	..	..	11	0	30	1
ROXBURGH.												
County jurisdiction ..	..	..	4	0	4	0	..	..	1	0	11	1
Burghs:												
Hawick	..	..	4	0	4	0	..	..	4	0	4	0
Jedburgh	..	..	2	0	3	0	..	..	1	0	1	1
Kelso	6	0	2	0	3	0	..	..	2	0	1	0
Melrose	9	0	4	3	8	1	1	0	1	0	3	0
TOTAL ..	15	0	16	3	22	1	1	0	9	0	20	2
SELKIRK.												
County jurisdiction ..	5	3	2	0	10	3	6	1	9	0	5	0
Burghs:												
Galashiels	..	..	..	..	4	0	1	0	1	0	2	0
Selkirk	4	0	12	2	10	0	4	0	..	..	1	0
TOTAL ..	9	3	14	2	24	3	11	1	10	0	8	0
STIRLING.												
Joint Committee* ..	47†	6†	26	6	97	17	2†	0†	7	0	28	3
Burghs:												
Falkirk	20	4	36	5	14	2	5	0	25	1	10	0
Kilsyth	2	0	5	1	8	0	1	0	6	0	..	..
Stirling	3	1	6	0	16	0	..	..	4	0	7	0
TOTAL ..	72	11	73	12	135	19	8	0	42	1	45	3
SUTHERLAND.												
County jurisdiction ..	..	..	..	..	..	..	..	..	1	1	4	0
Burgh:												
Dornoch	..	..	..	..	..	..	..	..	..	..	1	0
TOTAL ..	..	..	..	..	..	..	..	..	1	1	5	0

* Comprising County of Stirling, and Burghs of Bridge of Allan, Denny and Dunipace, and Grangemouth in 1901 and 1902.

† Figures for County of Stirling only.

STATEMENT SHOWING THE NUMBER OF SAMPLES OF MILK AND BUTTER, &c.—*continued.*

—	Milk.						Butter.					
	Nine months ended 30th September, 1900.		Year ended 30th September,				Nine months ended 30th September, 1900.		Year ended 30th September,			
			1901.		1902.				1901.		1902.	
	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.
HADDINGTON.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
County jurisdiction ..	..	..	3	1	5	1	—	—	..	—	0	0
Burghs:												
Cockenzie	..	..	..	..	2	0	..	..	..	—	2	0
Dunbar	..	..	..	..	9	3	..	..	..	—	—	—
East Linton	..	..	..	..	..	..	..	..	..	—	1	1
Haddington ..	..	..	2	2	4	0	..	..	..	—	1	0
North Berwick ..	2	2	..	..	2	0	..	..	1	1	2	2
Prestonpans ..	..	..	7	1	3	1	..	..	—	—	1	0
Tranent	..	..	—	—	6	2	..	..	—	—	3	0
TOTAL ..	2	2	12	4	25	7	..	..	1	1	10	3
INVERNESS.												
County jurisdiction ..	1	0	2	0	1	1	2	0	21	5	4	0
Burghs:												
Fort William ..	11	0	9	1	3	1	—	—	..	..	..	—
Inverness	10	0	19	1	16	3	..	—	0	0	6	0
Kingussie	..	..	..	..	1	0	—	..	..	..	—	—
TOTAL ..	22	0	30	2	21	5	2	0	21	5	10	0
KINCARDINE.												
County jurisdiction ..	—	—	—	—	2	0	..	..	4	2	1	0
Burghs:												
Banchory	..	..	—	—	—	..	..	..	—	..	..	..
Bervie or Inverbervie.	..	..	—	..	—	..	..	..	..	..	..	..
Laurencekirk ..	..	..	..	..	..	..	..	—	1	0	..	—
Stonehaven	..	..	1	0	7	0	..	..	1	0	5	0
TOTAL ..	..	..	1	0	9	0	..	..	6	2	6	0
KINROSS.												
County jurisdiction ..	2	1	11	3	—	..	..	..	9	0	3	0
Burgh:												
Kinross	8	0	—	—	7	0	..	—	..	..	..	—
TOTAL ..	10	1	11	3	7	0	..	—	9	0	3	0
KIRKCUDBRIGHT.												
Joint Committee* ..	..	..	1	0	23	1	..	..	6	0	15	0
Burghs:												
Castle Douglas ..	..	..	3	0	†	†	..	..	4	0	†	..
Gatehouse	..	..	..	..	†	†	..	..	—	—	†	..
Maxwelltown ..	3	0	2	0	3	0	3	0	2	0	1	0
New Galloway ..	..	..	..	—	†	†	..	..	—	..	†	0
TOTAL ..	3	0	6	0	26	1	3	0	12	0	16	0

* Includes the County of Kirkcudbright and the Burghs of Dalbeattie and Kirkcudbright in 1900 and 1901; in 1902 the Joint Committee also administered the Acts in the Burghs of Castle Douglas, Gatehouse and New Galloway.

† Included, if any, under "Joint Committee."

STATEMENT SHOWING THE NUMBER OF SAMPLES OF MILK AND BUTTER, &c.—*continued.*

—	Milk.						Butter.					
	Nine months ended 30th September, 1900.		Year ended 30th September,				Nine months ended 30th September, 1900.		Year ended 30th September,			
			1901.		1902.				1901.		1902.	
	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.
LANARK.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
County jurisdiction ..	11	3	31	5	[illegible]	12	[illegible]	7	[illegible]	5	[illegible]	[illegible]
Burghs:												
Airdrie	6	2	19	5	19	4	—	..	—	..	3	1
Biggar	..	—	..	..	2	0	—	..	1	0	..	—
Coatbridge	8	2	22	3	56	2	3	0	2	0	25	2
Glasgow	132	43	148	71	152	59	47	14	82	6	125	[illegible]
Govan	26	3	55	19	56	4	14	3	15	1	[illegible]	[illegible]
Hamilton	..	..	6	1	21	2	..	..	6	0	6	[illegible]
Kinning Park ..	..	..	6	2	8	2	2	0	2	0	3	[illegible]
Lanark	23	3	—	..	5	0	..	..	4	2	..	—
Motherwell ..	..	—	7	2	20	0	..	..	..	—	2	1
Partick	44	9	60	15	90	12	10	3	27	2	22	1
Rutherglen	3	1	8	1	17	2	2	0	1	0	3	1
Wishaw	..	—	9	1	6	0	..	..	..	—	..	—
TOTAL ..	245	65	377	114	[illegible]	190	106	27	169	16	295	25
LINLITHGOW.												
County jurisdiction ..	12	5	33	5	27	7	3	0	5	1	11	1
Burghs:												
Armadale	..	..	4	0	4	2	..	..	1	0	1	0
Bathgate	..	..	3	0	10	0	..	..	..	—	3	0
Borrowstounness ..	7	1	7	1	9	0	5	0	..	..	..	..
Linlithgow	1	0	20	1	6	1	2	0	..	..	1	0
Queensferry	..	..	..	—	5	0	..	..	..	..	2	0
Whitburn	—	..	..	..	3	3	..	..	..	..	2	0
TOTAL ..	20	1	30	7	65	13	10	0	6	1	20	1
MIDLOTHIAN.												
County jurisdiction ..	32	8	46	21	[illegible]	36	17	4	15	5	1	1
Burghs:												
Bonnyrigg	..	..	..	—	—	..	..	..	..	..	1	0
Dalkeith	2	2	16	8	3	2	..	..	1	0	3	0
Edinburgh	22	8	48	21	105	47	21	4	29	3	51	3
Lasswade	..	..	2	0	..	..	..	..	1	0	..	..
Leith	10	1	29	9	95	26	..	..	3	6	19	1
Loanhead	..	..	7	3	..	..	..	..	2	1	..	..
Musselburgh ..	..	..	..	—	3	4	..	..	..	..	5	0
Penicuik	..	..	8	2	9	5	..	..	..	..	8	0
TOTAL ..	67	20	159	61	254	126	38	19	51	7	84	8
NAIRN.												
County jurisdiction ..	—	—	1	0	..	—	—	..	1	0	—	—
Burgh:												
Nairn	—	—	..	..	4	3	..	..	1	0	1	0
TOTAL ..	—	..	1	0	4	3	..	..	2	0	1	0

STATEMENT SHOWING THE NUMBER OF SAMPLES OF MILK AND BUTTER, &c.—*continued.*

—	Milk.						Butter.					
	Nine months ended 30th September, 1900.		Year ended 30th September,				Nine months ended 30th September, 1900.		Year ended 30th September,			
			1901.		1902.				1901.		1902.	
	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.
ORKNEY.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Joint Committee* ..	..	..	..	..	3	2	..	..	—	—	..	..
Burgh:												
Kirkwall	14	0	..	..	9	1	3	0	5	1	6	0
TOTAL ..	14	0	..	..	12	3	3	0	5	1	6	0
PEEBLES.												
County jurisdiction ..	..	..	..	..	1	0	..	..	—	—	3	0
Burghs:												
Innerleithen ..	..	..	2	0	..	..	..	..	—	—	..	..
Peebles	4	0	..	..	3	1	..	..	—	—	3	0
TOTAL ..	4	0	2	0	4	1	..	..	—	—	6	0
PERTH.												
County jurisdiction ..	23	0	11	0	34	0	45	0	..	—	29	0
Burghs:												
Aberfeldy	..	..	1	0	5	0	..	..	..	—	2	0
Abernethy	..	..	..	..	1	0	..	..	..	—	2	0
Alyth	..	..	2	0	5	1	..	..	..	—	2	0
Auchterarder ..	..	..	1	0	5	0	..	..	..	—	2	0
Blairgowrie ..	..	..	1	0	1	0	..	..	..	—	2	0
Callander	..	..	1	0	4	0	..	..	..	—	1	0
Coupar Angus ..	..	..	..	..	7	0	..	..	—	—	1	0
Crieff	..	..	2	0	1	0	..	..	..	—	2	0
Doune..	..	..	1	0	..	..	..	..	..	—	..	..
Dunblane	..	..	1	0	5	0	..	..	..	—	1	0
Perth	15	3	30	2	41	9	10	6	30	0	15	0
Rattray	..	—	..	..	3	0	..	..	..	—	1	0
TOTAL ..	38	3	48	2	129	10	55	6	30	0	62	0
RENFREW.												
County jurisdiction ..	1	0	—	—	14	2	2	0	7	2	11	1
Burghs:												
Barrhead	—	—	3	0	1	0	..	..	3	0	3	0
Gourock	33	1	29	5	15	0	..	..	..	—	..	..
Greenock	47	2	171	12	102	22	7	1	9	3	18	0
Johnstone	..	..	..	..	12	1	..	..	..	—	..	..
Paisley	30	15	56	19	79	14	1	0	27	1	21	1
Pollokshaws ..	4	2	..	..	8	1	2	0	—	—	1	0
Port Glasgow ..	23	4	19	4	13	3	3	0	4	1	4	0
Renfrew	1	0	—	..	7	2	—	—	—	—	1	0
TOTAL ..	138	25	277	39	251	51	15	1	27	6	59	2

* Comprising the County of Orkney and the Burgh of Stromness.

STATEMENT SHOWING THE NUMBER OF SAMPLES OF MILK AND BUTTER, &c.—*continued.*

—	Milk.						Butter.					
	Nine months ended 30th September, 1900.		Year ended 30th September.				Nine months ended 30th September, 1900.		Year ended 30th September.			
			1901.		1902.				1901.		1902.	
	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.
ROSS AND CROMARTY.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
County jurisdiction ..	—	—	3	1	11	0	..	..	7	0	19	1
Burghs:												
Cromarty ..	—	—	—	..	..	..	..	..	..	..	[illegible]	[illegible]
Dingwall ..	—	—	—	..	5	0	..	..	..	..	[illegible]	[illegible]
Fortrose ..	—	—	—	..	..	..	..	..	..	..	[illegible]	[illegible]
Invergordon	—	—	—	..	2	1	..	..	..	..	[illegible]	[illegible]
Stornoway ..	—	—	3	0	1	1	..	..	3	0	[illegible]	[illegible]
Tain	—	—	—	..	4	0	—	..	1	0	..	..
TOTAL ..	—	—	6	1	27	2	..	..	11	0	30	1
ROXBURGH.												
County jurisdiction ..	..	—	4	0	6	0	..	..	1	0	11	1
Burghs:												
Hawick	..	..	4	0	6	0	..	..	[illegible]	0	[illegible]	0
Jedburgh ..	..	..	1	0	2	0	..	..	[illegible]	0	[illegible]	[illegible]
Kelso	6	0	3	0	5	0	..	..	[illegible]	0	[illegible]	0
Melrose ..	9	0	4	2	9	1	1	0	1	0	2	0
TOTAL ..	15	0	16	2	29	1	1	0	9	0	20	2
SELKIRK.												
County jurisdiction ..	5	2	2	0	10	0	6	1	9	0	5	0
Burghs:												
Galashiels ..	..	..	..	..	4	0	1	0	1	0	2	0
Selkirk ..	4	0	12	2	10	1	4	0	—	—	1	0
TOTAL ..	9	2	14	2	24	1	11	1	10	0	8	0
STIRLING.												
Joint Committee* ..	42†	4†	28	3	87	17	3†	0†	7	0	38	3
Burghs:												
Falkirk ..	25	4	36	8	34	2	2	0	25	1	10	0
Kilsyth ..	2	2	5	1	9	0	1	0	6	0	..	..
Stirling ..	3	1	4	0	16	0	—	—	4	0	7	0
TOTAL ..	72	11	73	12	146	19	6	0	42	1	55	3
SUTHERLAND.												
County jurisdiction ..	—	..	..	..	—	—	—	..	1	1	4	0
Burgh:												
Dornoch ..	—	..	..	..	..	—	—	..	..	—	1	0
TOTAL ..	..	..	..	..	..	—	—	—	1	1	5	0

* Comprising County of Stirling, and Burghs of Bridge of Allan, Denny and Dunipace, and Grangemouth in 1901 and 1902.

† Figures for County of Stirling only.

STATEMENT SHOWING THE NUMBER OF SAMPLES OF MILK AND BUTTER, &c.—*continued.*

—	Milk.						Butter.					
	Nine months ended 30th September, 1900.		Year ended 30th September.				Nine months ended 30th September, 1900.		Year ended 30th September.			
			1901.		1902.				1901.		1902.	
	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.	Examined.	Adulterated.
WIGTOWN.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
County Jurisdiction* ..	3	0	2	0	4	3	7	0	12	0	6	0
Burghs:												
Newton Stewart* ..	..	..	4	1	2	0	..	—	6	0	3	0
Stranraer	..	..	2	0	6	1	..	—	..	..	5	1
Whithorn	..	..	3	0	..	..	..	—	—	..	..	..
Wigtown*	..	..	..	..	4	0	..	—	..	..	..	..
TOTAL ..	3	0	11	1	16	4	7	0	18	0	14	1
ZETLAND.												
County Jurisdiction ..	—	—	..	—	—	—	—	—	..	..	..	—
Burgh:												
Lerwick	..	—	—	—	23	7	..	..	..	..	—	—
TOTAL ..	..	—	—	—	23	7	..	..	..	..	..	—

* A Joint Committee was formed on the 15th May, 1902, for the administration of the Acts in the County of Wigtown and the Burghs of Newton Stewart and Wigtown.

APPENDIX V.

On the Nature of Butter-fat and on the Causes Affecting its Character.

(By Dr. T. E. Thorpe, C.B., F.R.S., Principal Chemist of the Government Laboratory.)

Butter-fat, after separation from the water, curd, and salt with which it is associated in ordinary butter, consists essentially of a mixture of *glycerides*—that is, combinations of *glycerin*,

$$C_3H_5\begin{cases}OH\\OH\\OH\end{cases}$$

with various acids.

The following is a list, arranged in order of increasing molecular-weight, of the acids which have been recognised up to the present as entering into the composition of the glycerides of butter:—

Name.	Formula.	Molecular Weight.
Acetic	$C_2H_4O_2$	60
Butyric	$C_4H_8O_2$	88
Caproic	$C_6H_{12}O_2$	116
Caprylic	$C_8H_{16}O_2$	144
Capric	$C_{10}H_{20}O_2$	172
Lauric	$C_{12}H_{24}O_2$	200
Myristic	$C_{14}H_{28}O_2$	228
Palmitic	$C_{16}H_{32}O_2$	256
Oleic	$C_{18}H_{34}O_2$	282
Stearic	$C_{18}H_{36}O_2$	284
Arachidic	$C_{20}H_{40}O_2$	312
Dioxystearic	$C_{18}H_{34}O_2(OH)_2$	316

The precise nature of these glycerides cannot be said to be definitely established. It is practically certain that they are all *tri-glycerides*; that is combinations of one molecule of glycerin (propenyl) with three molecules of acid, but it is not equally certain that the three molecules are respectively of one and the same acid in all cases. There may be, and probably are, glycerides present such as *tri-olein*,

$$C_3H_5\left\{\begin{array}{l}O.\,C_{18}H_{33}O\\O.\,C_{18}H_{33}O;\\O.\,C_{18}H_{33}O\end{array}\right.$$

or *tri-palmitin* :—

$$C_3H_5\left\{\begin{array}{l}O.\,C_{16}H_{31}O\\O.\,C_{16}H_{31}O;\\O.\,C_{16}H_{31}O\end{array}\right.$$

or possibly, *tri-butyrin*:—

$$C_3H_5\left\{\begin{array}{l}O.\,C_4H_7O\\O.\,C_4H_7O.\\O.\,C_4H_7O\end{array}\right.$$

Each of these glycerides is a compound of glycerin with three molecules of a single acid.

But there is strong evidence that certain of the glycerides are of a mixed type, such as may be indicated by the following formulæ :—

$$C_3H_5\left\{\begin{array}{l}O.\,C_{18}H_{35}O\\O.\,C_{16}H_{31}O\\O.\,C_{18}H_{33}O\end{array}\right.$$

Stearo-palmito-olein, a compound of glycerin with the three acids stearic, palmitic, and oleic.

$$C_3H_5\left\{\begin{array}{l}O.\,C_4H_7O\\O.\,C_{16}H_{31}O\\O.\,C_{18}H_{33}O\end{array}\right.$$

Butyro-palmito-olein, a compound of glycerin with butyric, palmitic, and oleic acids.

$$C_3H_5\left\{\begin{array}{l}O.\,C_{16}H_{31}O\\O.\,C_{16}H_{31}O\\O.\,C_{18}H_{33}O\end{array}\right.$$

Di-palmito-olein, a compound of glycerin with two molecules of palmitic acid and one of oleic.

The possibility of this occurrence of complex glycerides was first clearly indicated by Mr. G. Lewin, working under Dr. Bell's directions in the Government laboratory ; and a practical confirmation of his observations was made by Wynter Blyth and Robertson, who isolated a crystalline glyceride from butter which proved on analysis to be a mixed propenyl ester of butyric, palmitic, and stearic acids :—

$$C_3H_5\left\{\begin{array}{l}O.\,C_4H_7O\\O.\,C_{16}H_{31}O\\O.\,C_{18}H_{35}O\end{array}\right.$$

Considering the number of acids which have been detected, it is obvious that the number of glycerides which may conceivably be present is very large

At the same time, analysis shows that the acids entering into the composition of these glycerides are present in very unequal proportions. Oleic, palmitic, myristic, and butyric acids together constitute in all probability about nine-tenths of the total amount, stearic, dioxystearic, lauric, capric, caprylic, and caproic acids together making up the remaining tenth.

The following analysis of butter-fat, by C. A. Browne (Journal of the American Chemical Society, 1899, p. 823), may serve to give some idea of

the relative amounts in which these various acids are present in combination as glycerides :—

Acid.	Percentage of Acid.	Percentage of Tri-glyceride.
Dioxystearic … …	1·00	1·04
Oleic … … …	32·50	33·95
Stearic … … …	1·83	1·91
Palmitic … … …	38·61 } = 50·33	40·51
Myristic … … …	9·89	10·44
Lauric … … …	2·57	2·73
Capric … … …	0·32	0·34
Caprylic … … …	0·49 } = 2·90	0·53
Caproic … … …	2·09	2·32
Butyric … … …	5·45	6·23
	94·75	100·00

In addition there are natural colouring-matters (so-called *lacto-chromes*), of the exact chemical nature of which but little is known, but which probably owe their origin to chlorophyll ; together with some form of *lecithin*, and *cholesterol*. These substances are present in very small quantities, and they make up the unsaponifiable matter of butter-fat, the total amount of which does not as a rule exceed one-tenth per cent.

The numbers given above express the results of the latest detailed analysis of butter-fat. To what extent they may be taken as representing the nature of butter-fat in general remains to be proved. Other more or less detailed analysis of the fatty acids in butter are as follows :—

Acid.	Observer.		
	Koefoed.	Bell.	Blyth.
	%	%	%
Oleic … …	33·74	36·10	40·48
Stearic … …	1·83		
Palmitic … …	25·62 } = 47·58	49·46	47·53
Myristic … …	20·13		
Lauric … …	7·92	—	—
Capric … …	1·83		} 0·60
Caprylic … …	0·46 } = 4·21	2·09	
Caproic … …	1·83		2·00
Butyric … …	5·27	6·13	3·49
Total …	96·68	93·78	94·53

The exact quantitative separation of so large a number of fatty acids is a problem of great experimental difficulty, and although the natural differences in the composition of butter-fat may explain to some extent the discrepancies in the above table, it can hardly be doubted that they are mainly to be ascribed to the imperfections of the processes employed. In spite, however, of the meagre nature of the analytical evidence, certain reasonably well-established conclusions may be drawn. Thus it appears that the oleic acid in butter is present as a rule to the extent of about one-third of the total weight of the acids, and that stearic, palmitic, and myristic acids together make up about half their weight. Of these acids palmitic is present in by far the largest proportion, the amount of stearic acid probably not exceeding two or three per cent. This last fact, if established beyond doubt, may prove of great significance, as butter-fat would thereby be sharply differentiated from other animal fats. The other acids—lauric, capric, caprylic, caproic, and butyric—together make up the remaining one-sixth; and of these butyric acid is present in largest proportion; usually—that is, in butter of normal composition—to the extent of about six per cent. of the whole of the fatty acids.

Butter-fat, like many other products of animal metabolism, is a substance of varying composition, and the nature and relative proportions of its constituent glycerides are affected by a number of causes. Thus they are dependent upon the idiosyncracy of the cow, the changing conditions of its existence, the nature and amount of its food, the period of lactation, &c., &c. As is well known, the nervous organization of the animal has also an important influence on the milk-secretion, but to what extent it affects the proportion or character of the glycerides in the milk-fat is not definitely made out. In fact the precise influence of all these agencies on the chemical composition of butter has been very imperfectly studied, mainly by reason of the tedious and imperfect nature of the analytical processes which are used to isolate and determine the nature and amount of the constituent glycerides. It has, however, been established that the proportion of olein is greatest in the early period of lactation. In some cases it may amount to as much as half the weight of the fat. After a certain period the palmitin and stearin increase, the amount of olein falling to less than half its maximum quantity. These changes are apparently associated with the variation in the size of the fat globules which occurs during the lactation period. As the globules decrease in size the proportion of olein also decreases and the fat becomes harder and of higher melting-point.

During the last five-and-twenty years a considerable body of analytical evidence has been accumulated concerning the influence of these factors of change upon certain physical and chemical characteristics of butter-fat, from which a limited number of important deductions are possible. This evidence has been accumulated concurrently with the rise and development of the margarine industry and largely in consequence of it. The fat of margarine mainly consists of glycerides of stearic, palmitic, myristic, &c., acids, and is distinguished from the fat of butter by the absence, or practical absence, of acids of relatively low molecular weight, such as butyric, caproic, caprylic, and capric, which, unlike myristic, palmitic, stearic, and oleic acids, are more or less readily volatilised, especially in a current of steam. The determination of the total amount of soluble acids, or of the acids which could be volatilised in a current of steam, might therefore, it was presumed, not only be made a means of differentiating between butter-fat and margarine, but also serve as a method of ascertaining the amount of margarine which might have been admixed with butter. Moreover, it was found that a given weight of butter-fat, as a rule, requires a larger amount of alkali to saponify it than is required by the same weight of margarine. On the other hand, when a given weight of butter-fat is treated with a reagent capable of yielding iodine to the glycerides, it will generally absorb a smaller quantity of iodine than the same weight of margarine-fat will take up: this absorption of iodine is a measure of the amount of oleic acid contained in the glycerides. The amount of iodine absorbed, calculated as a percentage on the fat, is generally referred to as the "*iodine number*" or the "*Hübl number*" of the fat.

Other points of contrast depending upon differences in the chemical composition of the two fats are found in their different deportment with certain solvents. Thus, if equal weights of butter-fat and margarine-fat be separately dissolved in similar volumes of hot acetic acid, and then allowed to cool, the glycerides of margarine begin to crystallise out, and render the liquid turbid, at a considerably higher temperature than do those of butter. This test with acetic acid is known as the "*Valenta*" test, after its discoverer. A somewhat similar experiment in which alcohol is used as the solvent is known as "*Crismer's test*," and the temperature of turbidity as the "*Crismer number.*" Moreover, different quantities of heat are evolved by the two fats when, under like conditions, their glycerides are chemically decomposed by treatment with strong sulphuric acid.

These differences in the chemical composition of butter-fat and margarine are accompanied by certain differences in physical properties of which advantage may be taken by the analyst. Thus butter-fat has almost invariably a higher relative density than any of the fats which are likely to be used to adulterate it. Its refractive index also is lower than that of any probable adulterants. This latter constant, as measured by the optical instrument most generally used, is known as the "*Zeiss number.*" As a rule, the lower the proportion of volatile acids in butter-fat, the higher is the Zeiss number. Its value for normal butter-fat at 45° C. ranges from about 38 to 43 divisions on the graduated scale attached to the instrument.

Founded upon the foregoing facts, various analytical processes have been devised in order to discriminate between butter and margarine, or between genuine butter and mixtures of butter and margarine. The following is a summary of the essential features of the methods, some or all of which are usually followed by the analyst in his examination of samples of butter :—

(1.) *Determination of Soluble and Insoluble Acids.*—In this process a small quantity of the butter-fat, separated from water and curd, is saponified by heating with an alcoholic solution of potash. By this treatment the fatty acids of the glycerides are liberated from their combination with the glycerin, and combine with the alkali to form a soap. From this soap, dissolved in hot water, they are set free by the addition of sulphuric acid, and on cooling the mixture the "insoluble fatty acids" are obtained as a solid cake upon the surface of the liquid, whilst in the latter the "soluble fatty acids" remain dissolved. The insoluble acids are separated from the liquid by filtration, washed with water to remove adherent soluble acids, dried, and weighed. The quantity of insoluble acids thus obtained, expressed as a percentage of the butter-fat, is usually referred to as the "*Hehner value*" of the butter, and in normal samples may range from about 86½ to 89. In margarine the value is about 95.

The soluble acids are contained in the liquid which has been filtered from the cake of insoluble acids. In order to ascertain their amount this acid liquid is neutralised with a standard solution of alkali, of which the volume required is carefully noted. The quantity of standard alkali used, after being corrected for the known amounts of potash and sulphuric acid employed in the earlier stages of the experiment, is a measure of the soluble acids in the liquid, and the weight of these acids can be at once calculated from the result obtained. As a rule, the soluble acids are from about 4½ to 7 per cent. of the butter-fat, whereas in margarine the figures are much lower, and usually less than 1 per cent.

(2.) *Volatile Fatty Acids.*—In determining the amount of these acids the butter-fat is first saponified and treated with sulphuric acid, as already described for the insoluble acids. Mixed with water in a flask the free fatty acids thus obtained are distilled, and the volatile members are in this way separated from the "fixed" or non-volatile acids. They are collected, together with the condenser steam, in a receiver, filtered from such small quantities of insoluble acids as may have also distilled over, and the amount of the dissolved volatile acids is then determined by neutralising the acid liquid with standard alkali.

This process, in one modification or another, is variously known as the Reichert, the Reichert-Meissl, or the Reichert-Wollny method of determining the amount of volatile acids in fats.

As confusion sometimes arises over the use of these terms, it may be well to offer here a short explanation of them.

The principle of the method—viz., that of separating the volatile acids by distillation—was originally worked out by Reichert, who, however, by repetition of the distilling process endeavoured to effect a complete separation even of the last traces of volatile acids. Subsequently Meissl introduced certain modifications, one of which consisted in using double the quantity of fat employed by Reichert, and then distilling over, not the whole, but a defined fraction of the volatile acids, so that a single distillation sufficed. Thus modified, the operation is known as the Reichert-Meissl process.

Afterwards the whole matter was very carefully examined by Wollny, who studied the causes of error still existing in the Reichert-Meissi method, and who showed, among other things, that to obtain closely concordant results it was important to always work with apparatus of the same dimensions, and to guard against the disturbing influence of atmospheric carbonic acid. Wollny, in short, laid down definite conditions as regards details of manipulation. By attention to these details the "personal equation" of the experimenter could be almost entirely eliminated; so that different chemists working upon the same fat could be certain of always obtaining practically identical results.

This improved form of the method is the one generally employed in this country, and it is known as the "Reichert-Wollny" process. The "*Reichert-Wollny number*" of a fat may be defined as the number of cubic centimetres of decinormal alkali which are required to neutralise the volatile acids yielded by five grammes of the fat, when examined by the Reichert-Wollny process. For butter-fat of normal composition the Reichert-Wollny number may range from about 24 to about 32; for margarine, not containing butter-fat, the number is generally about one or two.

In order to compare with "Reichert-Wollny" figures the results obtained by the original "Reichert" process require to be multiplied by 2·2, because in this method only one-half the quantity of fat is used, and because on account of the differences of procedure the "Reichert" process gives, proportionately, rather smaller figures than the Reichert-Wollny method, even when the difference in the quantity of fat is allowed for.

Before, however, any valid inference as to the amount of admixed margarine can be drawn from data obtained by the foregoing methods, it is necessary to have precise information as to the differences in these respects which genuine butter is liable to exhibit under the varying conditions in which it is produced. As the result of applying these tests to butter produced under known conditions, it has been found that butter-fat, derived from cows nearing the end of their lactation period, is invariably poor in acids of low molecular weight—that is, in volatile acids. Hence the butter obtained at such periods gives low Reichert-Wollny figures.

This was first clearly indicated by the late Professor L. F. Nilson, of Stockholm, who some years ago (*Zeitschrift fur Analytische Chemie*, Vol. 28) published the results of the analysis of over 800 samples of butter, obtained from the milk yielded by a herd of 15 cows. He found:—

(1.) That in the fat of colostrum the proportion of volatile acids is very low.

(2.) That the amount of these acids then rapidly increases and reaches a maximum in from five to seven days after the cows had calved.

(3.) That the volatile acids then gradually diminished until the close of the lactation period, although even at the end of this period the figure shown was rarely less than 26. The lowest value obtained was 25.

It has also been observed that cows exposed to cold, wet, or inclement weather give butter containing a relatively small proportion of butyric acid and its near homologues. Scanty pasture, too, is conducive to a lowering of the amounts of the volatile acids.

The joint effect of these influences is well illustrated in the character of a certain amount of Dutch butter produced during the autumn—say from the latter part of September to the early part of November. At this time of the year the cows, over a great part of Holland, are, as a rule, nearing the end of their lactation period, the weather is usually unsettled, the nights cold, and the pasturage scanty. The milk-fat produced under such conditions is frequently so low in volatile acids as to give rise to the supposition that the butter has been mixed with margarine. After the cows are stabled and in receipt of their usual winter food, the butter-fat quickly re-acquires its normal complement of the characteristic fatty acids of butter.

These results were confirmed by a Commission appointed in 1899 at the instance of the French Minister of Agriculture. Their conclusions are as follows (*Bulletin du Ministère de l'Agriculture*, 1901, p. 327):—

"1. Certain Dutch butters, during the months of October and November, show a composition sensibly different from that of French butters and approaching that of butters adulterated with margarine.

"2. This occurs only at one well-defined period of the year for about 2½ months (September 15th to the end of November).

"3. It would be wrong to generalise this fact, as certain interested persons have a tendency to do, and to extend it to the whole butter produce of the Netherlands; in these countries, indeed, even at this particular period of the year, there are a large number of butters having a normal composition.

"4. The lowering of the content of volatile acids in certain butters is due to the defective conditions under which the cows at grass are living—at a time when they are subjected to cold and damp they also are receiving insufficient nourishment.

"Taking into consideration the whole of our observations, it is clear that Dutch butters might have, all the year round, a normal composition if the herds were stabled at the first approach of cold, and thus sheltered from inclemencies of the weather, and fed in a more suitable manner.

"5. The defective conditions under which the cows are living at the time when they furnish butters poor in volatile acids, gives us the right to consider these products as 'abnormal.'

"Indeed, if the chemical expert, confronted with a butter poor in volatile acids, of Dutch origin, and manufactured during the months in question, cannot conscientiously state that this product has been adulterated with margarine, it is, on the other hand, his duty to declare that it is an 'abnormal butter.' In fact, on comparing it with the butters of our own country, he has the right to affirm that in France this butter is not a marketable product."

It follows from what has been stated that if the Dutch farmers could be induced to stable their cows at the first approach of winter, and provide them with a more plentiful supply of nourishment than they are able to obtain from the meadows in the late autumn, their butter would tend to have the same uniformity of character that distinguishes the product of their chief competitors in the English market.

Some interesting particulars relative to this question have been furnished me by the late Dr. Wereuskiold, of the State Laboratory, Christiania. He has forwarded the details of the analyses of a considerable number of samples of butter taken from the churns of various factories in Norway by the Government inspectors, and with these details are supplied certain facts respecting the stabling and feeding of the herds which produced the milk used by the factories in question.

It may be mentioned that a number of Norwegian samples, stated to be the same butter as many of those referred to by Dr. Werenskiold, have been examined in the Government Laboratory, London, and that this department has substantially confirmed the analytical figures obtained in Norway.

First come two series of samples, one taken in the winter and the other in the early spring, which presumably—though this is not expressly stated—represent the normal composition of the butter when the cows are properly stabled and fed. For the present purpose the results may be thus summarised :—

Butter taken from the Churns at various factories by the Norwegian Inspectors.

No. of Samples.	Date of Sampling.	Reichert-Wollny Figures.			Zeiss Number.		
		Lowest.	Highest.	Average.	Lowest.	Highest.	Average.
18	13th November to 22nd December, 1898.	26·8	30·7	30·4	38·6	39·5	39·3
8	22nd April to 3rd May, 1899.	29·6	31·9	31·2	39·2	41·6	39·9

Bearing in mind what has already been stated, viz., that the Reichert-Wollny value for butter of normal composition lies generally between 24 and 32, whilst the Zeiss number may vary from about 43 to 38, it will be seen that the figures indicate that the butters are normal samples in all cases.

The next series of samples deals with a little later period, extending up to the end of May. Dr. Werenskiold's remarks relative to one of the farms may be quoted as fairly typical of the particulars furnished for 11 out of the 12 samples referred to :—

> " The spring came very late this year, so the fodder has run short and
> " the cows have been under-fed ; their condition is not good, but their
> " health is all right. They had to be turned on pasture already from
> " the middle of May or a little later ; on the 24th May most of them
> " were on pasture. It is reported to me on the 24th and the 31st that
> " the weather had been cool and wet during the last three days before the
> " samples had been taken."

The results of the analysis of this series were as follows :—

No. of Samples.	Date of Sampling.	Reichert-Wollny Figures.			Zeiss Number.		
		Lowest.	Highest.	Average.	Lowest.	Highest.	Average.
12	24th May to 31st May, 1899.	22·5	31·5	26·9	39·9	43·7	41·9
Some individual samples ...		22·8	...	...	...	43·2	—
		23·6	—	...	...	42·6	—
		24·2	—	—	—	42·9	—

Comparing these results with those for the first two series, it will be seen that, coincident with the under-feeding, the average proportion of volatile acids has decreased, as is shown by the lower Reichert-Wollny number; and further, that some of the individual specimens now give for this number a value below the lowest limit (24) which has been mentioned as corresponding to normal butter. Meanwhile the refractive index of the fat has become higher, so that the Zeiss number in one instance slightly exceeds, and in two other cases is practically coincident with, the value (43) which has been mentioned as the maximum for normal butter-fat.

In some of the foregoing cases good food would certainly appear at one time to have been very scanty, since it is remarked that, in addition to "cotton-seed meal, rape-cakes, and bran," the bark of certain species of *Prunus*, *Populus*, and *Betula* had also been used as fodder.

In the case of one dairy, however, the report is that "all the cows are in the stable, and will be turned on pasture during the first days of June. Their health is good; feeding and condition average." The butter taken from this dairy gave a Reichert-Wollny figure of 28·6 and a Zeiss number 40·1.

Next comes a series of 25 analyses, of which the summarised figures are:—

No. of Samples.	Dates of Sampling.	Reichert-Wollny Figures.			Zeiss Numbers.		
		Lowest.	Highest.	Average.	Lowest.	Highest.	Average.
25	16th May to 17th June, 1899.	21·1	32·2	28·1	39·6	43·7	40·9
Some individual samples ...		21·1	...	...	...	43·7	...
		21·1	...	...	...	43·7	...
		22·0	...	...	...	43·4	...
		22·0	...	...	...	43·1	...
		23·4	...	...	...	43·5	...

Here the average value for the volatile acids is higher than in the last series, and that for the refraction is correspondingly lower. At the same time, the series includes five samples giving what may be called "abnormal" figures. The series, in fact, includes specimens of the products obtained from eight different dairies; and the lesson to be learnt from a perusal of all the details furnished is that the samples of abnormal quality were all derived from farms where the cows, out at pasture, were reported as being in lean condition from under-feeding, and where, too, the weather had been for the most part wet and cold at the period covered by the sampling. On the other hand, where the weather had been warm and dry, or the cows still stabled and in good condition, the butter was of normal composition. This is perhaps best illustrated by the figures and the report for one dairy of each kind :—

I.—Factory giving "Abnormal" Butter.

Date of Sampling.	Reichert-Wollny Number.	Zeiss Number.
2nd June	22·0	43·1
7th "	22·0	43·4
13th "	21·1	43·7
17th "	21·1	43·7

"Weather cold and partly rainy." Cows at pasture ; underfed ; condition not good.

II.—Factory giving Normal Butter.

Date of Sampling.	Reichert-Wollny Number.	Zeiss Number.
16th May	30·9	39·8
29th "	30·8	39·9
10th June	30·0	39·9

"Health, feeding, and condition of the cows are good. They are yet in the stable."

For another factory the report was "Health very good ; feeding and con- "dition average. Four-fifths of them are now on pasture. Weather warm "and dry." The two samples from this dairy gave an average Reichert-Wollny figure of 28·2 and a Zeiss number 40·4, both samples being of normal composition.

It should, however, be remarked that Dr. Werenskiold subsequently furnished figures showing that some of the factories which had previously yielded "abnormal" butter were still to some extent producing butter of similar character, even when, in the latter part of June, the weather had become warm and dry. Probably the explanation of this is that the cows had not yet sufficiently recuperated. A little later on the butter from these dairies was yielding normal figures.

If further evidence were required as to the effect of inclement weather and scanty food upon the composition of butter-fat, it would be furnished by a report which has been made to the Royal Agricultural Society of Denmark by Messrs. Boggild and Stein. The report describes some experiments, carefully devised to elucidate the matter, which have been carried out in Denmark with the view of obtaining direct evidence as to some of the causes which may give rise to abnormal butter. The following is a short summary of the experiments and their results :—

Twelve cows, due to calve between the end of November and some time in February, were selected for the trials, which were carried out in 1896 upon the estate of the President of the Society, Count Danneskiold-Samsoe. These twelve cows were divided into four sets of three, the sets being as nearly equal as possible.

Experiment (1).—At first all four sets (I., II., III., and IV.) were out at pasture. As long as this was so (4th to 15th September), the butter yielded by each set was "abnormal" ; it had a low proportion of volatile acids and a high refraction number

Experiment (2).—On 17th September, Sets I. and II. were stabled. Set I. was fed on cold, wet grass and lucerne; Set II. was given a liberal diet of corn, cake, hay, roots, and straw.

The butter from Set I. showed a slight improvement, but was still "abnormal." That from Set II. had become normal in less than a week.

Of the other two Sets, III. was left just as before, but IV., whilst still remaining in the fields, was given from the 17th September a liberal allowance of corn and cake, in addition to the grass.

Neither of these two Sets showed any improvement in the analytical figures of the butter. The better diet in the case of IV. had no effect whilst the cows were still suffering from exposure to cold weather.

Experiment (3).—Sets III. and IV. were then stabled at night only, but turned out during the day. Set III. was given a little corn and cake (2 lbs. per head); the diet for IV. was the same as before. Sets I. and II. remained as in Experiment (2).

The butter produced gave in all cases practically the same results as in Experiment (2). Stabling III. and IV. at night alone had no effect; the exposure during the daytime still produced low Reichert-Wollny numbers and high refraction.

Experiment (4).—On the 15th October all the cows were taken into stables and fed liberally on good corn and cake, hay and roots.

Five days later, on 20th October, the butter in all cases gave normal figures, showing the immediate effect of the warm stabling and good dry feeding in increasing the proportion of volatile acids and in reducing the refraction.

The conclusion arrived at is, therefore, that "exposure to cold weather
" and feeding on cold, wet, poor grass, produces high refraction and low
" content of volatile acids in the butter-fat. Better feeding alone, or warmer
" surroundings alone, has little or no effect, but, combined, they have a
" marked effect in reducing the refraction and increasing the Reichert-
" Wollny figure."

Regarding the judicious selection of the foodstuffs, and their effects upon the milk, the Dairy Inspector of Norway in his report (1894—Journal of the Board of Agriculture, Vol. I., 1894, page 68) states: "Too small a quantity of artificial feeding stuffs, especially oil cake, is often used in winter, and . . . . . the milk yields a deficient quantity of butter, poor in fat. Even worse results are said to arise from a one-sided system of feeding with such fodders as brewers' grains, turnips, fish cake, and fish meal—these materials can be used with advantage only in small quantities, mixed with large proportions of recognized good artificial foods."

The influence exerted by various foods on the composition of butter has been studied by a number of observers. Appended are summaries of some of the results obtained, together with the authorities responsible for them.

All authorities agree that food exerts a very great influence on the firmness of butter, and that nearly all foods have some influence on its flavour. Green fodder tends to produce butter of low melting point and comparatively rich in volatile acids; mangel-wurzel also gives butter with a high percentage of volatile acids.

Hay and silage, on the other hand, tend to give butter with a high melting point. (Mayer.)

The volatile acids decrease in amount when no cereals are given (Vieth). Oats, decorticated cotton cake, beans and peas are found to be beneficial in their effects on butter, but linseed meal, grains, Paisley meal and foods containing a large proportion of sugar are best discarded, or at least reduced to a minimum (Speir).

Cotton seed tends to produce a butter of high melting point with a consequent diminution in the volatile acids, but with no change in the specific gravity of the fat or its colour (Lupton).

Attempts are occasionally made to influence the amount and nature of the fat in milk by the use of foods containing fat. The testimony as to the value of such foods in augmenting the amount of milk fat is conflicting, but the weight of the evidence goes to show that, although in certain cases fat may have an indirect beneficial effect, nevertheless in the case of a normally fed animal it has no contributory action on the amounts of the glycerides secreted.

Baumert and Falke have, however, stated that not only is butter-fat greatly changed in character through feeding with various fats, but the alteration is always characteristic of the fats used—that is, the butter-fats produced by feeding cows with sesamé, cocoa-nut or almond oil exhibit on analysis the same characteristics as are found in artificial mixtures of butter-fat with these three oils.

According to Bartlet, gluten food containing much oil produces soft butter, yet when free from fat the gluten will not have the hardening effect of cotton seed meal; soft butter cannot be attributed to an excess of fat or to a deficiency of nitrogenous food.

Hills tried the effect of adding various oils to food, and found that with cotton seed oil the butter was hard and of good quality; linseed meal rendered it soft and sticky, whereas maize oil made it soft and oily.

In this connection mention may be made of the results of certain feeding experiments made at the Wye Agricultural College, at the instance of the Board of Agriculture, which are of importance in relation to the search for certain vegetable oils in butter, as indicative of the presence of oleo-margarine. The samples of butter produced by the cows so fed were tested at the Government laboratory. It was found that:—

1. Cows fed on cotton seed cake give a butter which shows a reaction for cotton seed oil.

2. The above is true even when only a small quantity is given, and increases with continuous feeding up to a certain limit which cannot be passed.

3. The reacting substance passes into the milk within 24 hours, and continues several days after the food is stopped.

4. The intensity of the reactions varies with different cows, but does not in any case indicate a greater amount than 1 per cent. of cotton seed oil in the butter.

5. Feeding on cotton seed cake gives a butter which, on analysis, shows results tending to diverge still more widely than usual from those yielded by margarine, thus making it easier to distinguish between this and a mixture of margarine and cotton seed oil.

6. Feeding with sesamé cake gives no reaction for sesamé oil in the butter, even after it has been continued for two months.

This last observation is of importance in view of the compulsory use of sesamé oil in the manufacture of margarine in Germany and Belgium. As sesamé oil may be readily detected by comparatively simple tests, the presence of such margarine in butter may be easily recognised.

The flavour of butter, upon which its commercial value so largely depends, is not directly connected with the nature or amount of its constituent glycerides. Flavour would appear to be the result of the action of bacteria, and the extent and character of the flavour would seem to be materially affected by the conditions under which the micro-organisms exist. That the chemical nature of the fats in the milk—that is, the nature and relative proportion of the fatty acids—has little or nothing to do with the flavour would seem to be proved by the fact that the same cream will yield butters of very different flavour, depending on the manner in which the cream is raised. The butter from separated cream is as a rule markedly different in flavour from that made from shallow pan cream.

If butter-fat be sealed up and kept in a cold, dark place, it will retain its normal character and appearance for many months, but if kept in a warm locality, with free exposure to light and air, it will very speedily undergo chemical and physical changes, and become, as we say, rancid.

According to Browne (J. Amer. Chem. Soc., 1899, 975), by the term "rancidity" is not simply meant, as is generally supposed, a development of free acid—though this is usually an attendant circumstance—but simply oxidation, and in the early stages of the process butter-fat may lose its characteristic colour and smell, and develop an abnormal taste without showing an excessive degree of acidity.

That rancidity in butter is primarily the result of the activity of bacteria is no doubt partly true of whole butter, with its lactose, casein and other constituents to serve as bacterial food, but it is certainly not the case with pure butter-fat which is unable to support micro-organic life. The independent researches of Duclaux and Ritsert prove that bacteria cannot thrive in a medium of pure fat, and that all changes which take place in fats on keeping are wholly the result of an oxidation, conditioned to a great extent by exposure to light.

The three factors most active in the production of rancidity in butter-fat are air, light, and warmth; and decomposition occurs most rapidly when all three conditions are favourable. In the development of rancidity there are observed first of all several changes as regards colour, odour, taste, and general appearance: the sample begins to acquire a lighter colour, the change appearing first on the surface and parts most exposed to light, from which points the action spreads slowly downwards until finally the whole mass has become bleached. With this loss of colour is noticed also the development of a characteristic so-called "lardy" smell and taste; and as the rancidity becomes greater the smell increases in pungency, whilst the taste, which at first was not markedly acid, becomes exceedingly burning and unpleasant. In addition, there are changes in the consistency of the butter-fat. Originally firm and solid in texture, it assumes a granular appearance, and, after many months, finally turns into a semi-solid pasty mass.

On determining the various chemical and physical constants of the fat at various stages of its rancidity, and comparing them with those obtained when it was in a fresh state, certain characteristic changes are noticed. (Browne, *loc. cit.*). With the development of rancidity we usually observe a decided increase in the amount of free acid, in the saponification and Reichert numbers, as well as in the specific gravity, with a decrease in the insoluble fatty acids and iodine absorption—the latter being of a very marked description. The constituent in butter-fat which is most susceptible to chemical change is oleic acid; this being an unsaturated compound absorbs oxygen with great avidity, yielding either oxy-compounds or decomposing into simpler bodies of lower molecular weight: this instability and the chemical changes consequent upon it serve to explain the alterations in the constants mentioned above.

The free acid which soon makes its appearance is due not simply to oleic acid and its decomposition products but to other acids as well. In the development of rancidity there seems to be a gradual breaking up of all the glycerides, the acid part of the molecule splitting off from the glycerol residue, which itself probably undergoes change, and in the case of the complex oleins, the changes which so soon affect the oleic acid would no doubt hasten the disintegration of the entire glyceride.

It is however to be noticed that the amount of *free* volatile or soluble acids in rancid butter-fat is much smaller than might be expected if the explanations of rancidity here brought forward are valid. Why is it that these acids do not appear to any great extent in the free condition? This is probably explained by the fact that the first products formed by the decomposition of oleic acid are not acids, but aldehydes: these aldehyde bodies are further changed by oxidation into soluble acids, but this takes place only in an advanced state of rancidity, which explains a fact frequently noticed, viz., that free soluble acids are not formed to any great extent except in rancid fats of considerable age. By the action of alcoholic potash aldehydes are decomposed into acids and small quantities of dark resinous compounds. This would account for the fact that the soluble acids of decomposition do not appear until after saponification, and would also explain the brown colouration that rancid fats undergo when treated with alkalis. The peculiar odour, as well as the reducing action on silver solutions, are both explained by the presence of bodies of an aldehyde nature in rancid fat.

Other changes which are usually noticed as a butter-fat becomes rancid are the increase of the refractive index, and the lowering of the Crismer number, this lowering being roughly proportional to the acidity.

If bodies of a nitrogenous character be mixed with the butter-fat, then rancidity occurs much more quickly, and the decomposition of the glycerides is much accelerated by the aid of micro-organisms, yeast and moulds.

APPENDIX

Merchandise Marks

STATEMENT SHOWING THE PROSECUTIONS INSTITUTED BY THE BOARD OF
MERCHANDISE MARKS (PROSECUTIONS)

Place of Hearing.	Date of Hearing.	Description of Defendant.	No. of Informations.	Nature of Alleged Offence.
I. North London Police Court.	1902. Jan. 20	Provision merchant.	1	Fraudulently causing a false trade description to be applied to an American ham.
			1	Selling the said ham
		Shopman to the said merchant.	1	Fraudulently applying a false trade description to an American ham.
			1	Selling the said ham
II. Westminster Police Court.	Jan. 23	Provision merchants.	1	Fraudulently causing a false trade description to be applied to an American ham.
			1	Selling the said ham
		Shopman to the said merchants.	1	Fraudulently applying a false trade description to an American ham.
			1	Selling the said ham
III. South-Western Police Court.	Jan. 27	Provision merchant.	1	Fraudulently causing a false trade description to be applied to an American ham.
			1	Selling the said ham
		Shopman to the said merchant.	1	Fraudulently applying a false trade description to an American ham.
			1	Selling the said ham
IV. Woolwich Police Court.	Jan. 29	Provision merchant.	1	Fraudulently causing a false trade description to be applied to an American ham.
			1	Selling the said ham
		Shopman to the said merchant.	1	Fraudulently applying a false trade description to an American ham.
			1	Selling the said ham

VI.

Act, 1887 to 1894.

AGRICULTURE UNDER THE MERCHANDISE MARKS ACT, 1887, AND
ACT, 1894, DURING THE YEAR 1902.

Decision of the Court.	Amount of Penalty.	Amount of Expenses.	Remarks.
	£ s. d.		
Convicted	5 0 0	2s.	In default, 2 months' imprisonment.
do.	5 0 0	£8 8s.	do.
do.	5 0 0	2s.	do.
do.	5 0 0	2s.	do.
do.	10 0 0	£3 3s.	
do.	...	2s.	
..	...	...	The shopman had left the shop before the summonses were issued, and he could not be traced.
...	..	...	
do.	5 0 0	2s.	
do.	5 0 0	£3 3s.	
do.	0 10 0	2s.	
do.	0 10 0	2s.	
do.	5 0 0	£2 2s.	As a matter of convenience to the Court, the fine was inflicted in respect of the first summons.
do.	...	...	
do.	5 0 0	£2 2s.	do.
do.	...	...	

PROSECUTIONS BY THE BOARD OF AGRICULTURE UNDER THE

Place of Hearing.	Date of Hearing.	Description of Defendant.	No. of Informations.	Nature of Alleged Offence.
V. North London Police Court.	1902. Jan. 31	Provision merchant.	1	Fraudulently causing a false trade description to be applied to an American ham.
			1	Selling the said ham
		Shopman to the said merchant.	1	Fraudulently applying a false trade description to an American ham.
			1	Selling the said ham
VI. West London Police Court.	Feb. 4	Provision merchant.	1	Fraudulently causing a false trade description to be applied to an American ham.
			1	Selling the said ham
		Shopman to the said merchant.	1	Fraudulently applying a false trade description to an American ham.
			1	Selling the said ham
VII. Tottenham Petty Sessions.	Feb. 28	Provision merchant.	1	Fraudulently causing a false trade description to be applied to an American ham.
			1	Selling the said ham...
		Shopman to the said merchant.	1	Fraudulently applying a false trade description to an American ham.
			1	Selling the said ham...
VIII. Oxford Petty Sessions.	Mar. 14	Provision merchant.	1	Selling an American ham to which a false trade description was applied.
		Shopman to said merchant.	1	do.
IX. Cardiff Petty Sessions.	Mar. 18	Provision merchant.	1	do.
		Shopman to said merchant.	1	do.
X. Newport Petty Sessions.	Mar. 19	Provision merchant.	1	do.
		Shopman to said merchant.	1	do.

MERCHANDISE MARKS ACTS, 1887 TO 1894—(*continued*).

Decision of the Court.	Amount of Penalty.	Amount of Expenses.	Remarks.
	£ s. d.		
Convicted	...	2*s.*	
do.	5 0 0	2*s.*	
do.	...	2*s.*	
do.	10 0 0	£2 4*s.*	
Dismissed	...	...	Defendant called witnesses proving that, since the case of Coppin *v.* Moore (1898: 2 Q.B. 300), he had given explicit instructions to his shopman not to sell American hams as English.
do.	...	...	
do.	...	...	Defendant, who had previously entered "S.C. Ham" (*i.e.*, short cut ham) on the invoice, proved that it was at the repeated request of the agent of the Bacon Curers' Association, who purchased the ham, that he added the word "English."
do.	...	...	
Summons withdrawn.	...	.	
Convicted	5 0 0	£2 4*s.*	In default, one month's imprisonment.
Summons withdrawn.	...	...	
Convicted	2 0 0	2*s.*	In default, 21 days' imprisonment.
do.	25 0 0	£1 10*s.* and Court fees.	Previous conviction proved.
do.	2 0 0	Court fees	
do.	16 0 0	£8 8*s.* and Court fees.	
do.	1 0 0	Court fees	
Dismissed	...	...	The provision merchant swore that he had given definite instructions to his shopman that the ham was only to be sold as an American ham.
Convicted	1 17 0	£3 3*s.*	

PROSECUTIONS BY THE BOARD OF AGRICULTURE UNDER THE

Place of Hearing.	Date of Hearing.	Description of Defendant.	No. of Informations.	Nature of Alleged Offence.
XI. Bristol Petty Sessions.	1902. Mar. 20	Provision dealer	1	Selling an American ham to which a false trade description was applied.
		Manager to said dealer.	1	do.
XII. Hastings Petty Sessions.	Mar. 22	Provision merchant.	1	do.
		Shopman to said merchant.	1	do.
XIII. do.	do.	Provision merchants.	1	do.
		Shopman to said merchants.	1	do.
XIV. do.	do.	Provision merchant.	1	do.
		Shopman to said merchant.	1	do.
XV. Folkestone Petty Sessions.	Mar. 24	Provision merchant.	1	do.
		Shopman to said merchant.	1	do.
XVI. Margate Petty Sessions.	Mar. 25	Provision merchant.	1	do.
XVII. Bournemouth Petty Sessions.	Mar. 27	do.	1	do.
XVIII. Devonport Petty Sessions.	April 2	do.	1	do.
XIX. Plymouth Petty Sessions.	April 3	do.	1	do.
		Shopman to the said merchant.	1	do.
XX. Windsor Petty Sessions.	April 7	Provision merchant.	1	do.
		Shopman to the said merchant.	1	do.
XXI. Maidenhead Petty Sessions.	April 21	Provision merchant.	1	do.

MERCHANDISE MARKS ACTS, 1887 TO 1894—(*continued*).

Decision of the Court.	Amount of		Remarks.
	Penalty.	Expenses.	
	£ s. d.		
Dismissed	...	...	Magistrates found that the provision dealer, who was absent at the time of the sale, had taken reasonable precautions and had acted innocently.
Convicted	2 0 0	£0 3s. and Court fees.	
do.	2 0 0	£1 8s. and Court fees.	
do.	0 1 0	...	
do.	2 0 0	£1 8s. and Court fees.	
Dismissed	...	...	Magistrates found that the shopman had acted innocently.
Convicted	2 0 0	£1 8s. and Court fees.	
do.	0 1 0	...	
do.	2 0 0	£5 8s. and Court fees.	
do.	2 0 0	Court fees	
do.	2 0 0	do.	
do.	0 5 0	The Court costs of the summons.	
do.	1 0 0	Costs	
do.	3 0 0	Court fees	
do.	1 0 0	...	
Dismissed	...	...	The magistrates found that the shopman, who effected the sale, had acted innocently and dismissed the summonses.
do.	...	...	
Convicted	1 0 0	£2 2s. and Court fees.	

APPENDIX VII.

Merchandise Marks Acts, 1887 to 1894.

(No. 1.)

A $\frac{50}{C}$

CIRCULAR TO SECRETARIES OF CHAMBERS OF AGRICULTURE, AGRICULTURAL SOCIETIES, AND FARMERS' CLUBS.

BOARD OF AGRICULTURE,
4, *Whitehall Place,*
London, S.W.,
1st February, 1895.

MERCHANDISE MARKS (PROSECUTIONS) ACT, 1894.

SIR,

I AM directed by the Board of Agriculture to say that they think it may be useful that they should communicate to you the following information as to the effect of the Merchandise Marks (Prosecutions) Act, 1894, and as to the procedure to be adopted on applications for prosecutions thereunder.

The Act referred to enabled the Board, with the concurrence of the Lord Chancellor, to make regulations providing that in cases appearing to the Board to relate to agricultural or horticultural produce, and to affect the general interests of the country, or of a section of the community, or of a trade, the prosecution of offences under the Merchandise Marks Act, 1887, should be undertaken by the Board, under such conditions as they might prescribe, and the Board have accordingly, with the concurrence of the Lord Chancellor, made regulations in the following form :—

1. The Board of Agriculture shall, where it appears to them from the statements hereinafter mentioned that there is a reasonable prospect of a conviction being obtained, and subject to the other conditions in the next following regulation prescribed, undertake the prosecution of offences under the Merchandise Marks Act, 1887, in cases which appear to the Board to relate to agricultural or horticultural produce and to affect the general interests of the country, or of a section of the community, or of a trade.

2. (i.) Every application to the Board to undertake a prosecution shall be accompanied by the following documents :—

(a.) A statement showing the nature and circumstances of the case, and sufficient to enable the Board to form an opinion whether the case relates to agricultural or horticultural produce and affects the general interests of the country, or of a section of the community, or of a trade.

(b.) A statement of the facts capable of proof, with the names and addresses of the witnesses available to prove such facts.

(ii.) The Board may require the above statements to be supplemented or additional evidence to be furnished.

3. For the purpose of carrying the foregoing regulations into effect, the Board may, from time to time, prescribe the use of such forms and give such directions as they may deem expedient.

The Merchandise Marks Act, 1887, provided, *inter alia*, that every person who applies any false trade description to goods shall, subject to the provisions of the Act, and unless he proves that he acted without intent to defraud, be guilty of an offence under the Act, and although various other offences of an analogous character are specified in the Act of 1887, the Board apprehend that the provision above cited is that to which it will most frequently be necessary to resort in order to check the malpractices of which complaint has been so generally made amongst British agriculturists.

It is important to observe that the expression "goods" in the Act of 1887 is defined to mean "anything which is the subject of trade, manufacture, or "merchandise"; that the expression "trade description" is defined by the Act to mean "any description, statement, or other indication, direct or "indirect, (*a*) as to the number, quantity, measure, gauge, or weight of any "goods, or (*b*) as to the place or country in which any goods were made or "produced, or (*c*) as to the mode of manufacturing or producing any goods, "or (*d*) as to the material of which any goods are composed, or (*e*) as to any "goods being the subject of an existing patent, privilege, or copyright"; that the use of any figure, word, or mark which, according to the custom of the trade, is commonly taken to be an indication of any of the above matters, is to be deemed to be a trade description within the meaning of the Act; and, lastly, that the expression "false trade description" is defined to mean "a trade description which is false in a material respect, as regards the "goods to which it is applied, and includes every alteration of a trade "description, whether by way of addition, effacement, or otherwise, where "that alteration makes the description false in a material respect," and that the fact that a trade description is a trade mark, or part of a trade mark, is not to prevent such trade description from being a false trade description within the meaning of the Act.

The Board have little doubt that the law as it now stands should be sufficient to enable cases in which fraudulent misrepresentations of the place of origin are applied to agricultural produce to be dealt with as they deserve, and, so far as the Board are concerned, they will be very willing to exercise the new powers which Parliament has conferred upon them with a view to the removal of the sense of grievance which undoubtedly exists on the part of many agriculturists in respect to what they consider, and, in the opinion of the Board, very legitimately so, as competition unfair in character.

The Board have certainly no wish that the Act passed last Session under their auspices should remain a dead letter so long as any legitimate ground for complaint on the part of home producers remains, but it is beyond the power of the Board to be of assistance in this matter unless agriculturists themselves are able and willing, either individually or through the instrumentality of their various organisations, to co-operate with the Board by bringing under their notice specific cases in which there is *primâ facie* ground for believing that an offence under the Act of 1887 has been committed.

The Board would be glad, therefore, if you would take steps to bring this matter under the notice of your fellow members at an early opportunity, with a view to its being considered whether any, and if so, what, action can be taken by them in the direction indicated in the preceding paragraph. Applications which may be made to the Board to undertake prosecutions for offences under the Act of 1887 should comply fully with the requirements of the regulations above set out, and it is desirable that they should be made as soon as possible after the alleged offence has been committed.

I am, Sir,
Your obedient Servant,

T. H. ELLIOTT,
Secretary.

APPENDIX VIII.

Fertilisers and Feeding Stuffs Act, 1893.

Statement showing the Number of Samples of Fertilisers and Feeding Stuffs Analysed, under the Fertilisers and Feeding Stuffs Act, 1893, in each of the Counties and Boroughs from which Analyses were reported in 1902 and 1901.

County or Borough Reporting Analyses.	Number of Samples Analysed.					
	1902.			1901.		
	Fertilisers.	Feeding Stuffs.	Total.	Fertilisers.	Feeding Stuffs.	Total.
England:						
Counties:—						
Bedford	2	—	2	—	—	—
Bucks	—	1	1	—	—	—
Chester	9	1	10	5	1	6
Cornwall	21	—	21	10	3	13
Cumberland	12	16	28	3	1	4
Devon	15	17	32	10	2	12
Dorset	1	17	18	1	21	22
Durham	21	11	32	16	15	31
Essex	10	8	18	10	6	16
Gloucester	5	4	9	2	1	3
Hants	—	13	13	2	10	12
Hereford	42	4	46	29	1	30
Herts	1	6	7	—	4	4
Huntingdon	3	2	5	—	—	—
Kent	30	11	41	33	—	33
Lancaster	1	2	3	—	1	1
Leicester	4	3	7	2	—	2
Lincoln, Parts of Holland.	—	2	2	—	—	—
London	—	3	3	—	1	1
Monmouth	31	46	77	37	47	84
Northumberland ...	1	1	2	1	—	1
Oxford	2	4	6	3	1	4
Salop	25	23	48	23	36	59
Somerset	15	1	16	10	2	12
Carried forward ...	251	197	448	190	129	320

STATEMENT SHOWING THE NUMBER OF SAMPLES OF FERTILISERS AND FEEDING STUFFS ANALYSED, &c.—*continued.*

County or Borough Reporting Analyses.	Number of Samples Analysed.					
	1902.			1901.		
	Fertilisers.	Feeding Stuffs.	Total.	Fertilisers.	Feeding Stuffs.	Total.
ENGLAND, *continued*:						
Brought forward ...	251	197	448	191	129	320
Stafford	3	1	4	10	—	10
Suffolk, East	2	—	2	—	—	—
Suffolk, West	2	1	3	—	—	—
Surrey	11	—	11	5	—	5
Sussex, East	8	15	23	6	2	8
Sussex, West	—	—	—	1	—	1
Westmorland	20	7	27	22	4	26
Wilts	19	71	90	11	52	63
Worcester	16	2	18	23	1	24
York, East Riding ...	3	6	9	2	—	2
„ **North Riding** ...	4	12	16	6	—	6
„ **West Riding** ...	9	4	13	7	5	12
County Boroughs:						
Canterbury	19	10	29	20	7	27
Newport, Mon. ...	11	17	28	12	15	27
Total, England ...	378	343	721	316	215	531
WALES:						
Counties:—						
Anglesey	—	2	2	1	—	1
Cardigan	12	—	12	5	3	8
Carmarthen	55	13	68	21	20	41
Denbigh...	1	2	3	2	—	2
Flint	3	2	5	6	6	12
Glamorgan	24	75	99	24	63	87
Merioneth	—	—	—	1	—	1
Montgomery	15	1	16	10	5	15
Pembroke	20	—	20	11	2	13
Total, Wales ...	130	95	225	81	99	180

STATEMENT SHOWING THE NUMBER OF SAMPLES OF FERTILISERS AND FEEDING STUFFS ANALYSED, &c.—*continued.*

County or Burgh Reporting Analyses.	Number of Samples Analysed.					
	1900.			1901.		
	Fertilisers.	Feeding Stuffs.	Total.	Fertilisers.	Feeding Stuffs.	Total.
SCOTLAND:						
Counties:—						
Aberdeen	36	14	50	39	7	46
Argyll	19	4	23	3	—	3
Ayr	29	6	35	35	—	35
Banff	12	1	13	10	1	11
Berwick	3	3	6	2	2	4
Bute	—	1	1	—	—	—
Caithness	3	7	10	9	2	11
Dumfries	6	1	7	7	3	10
Fife	2	—	2	—	—	—
Forfar	1	3	4	—	5	5
Inverness	1	—	1	—	—	—
Kincardine	5	2	7	8	2	10
Kinross	—	—	—	—	1	1
Kirkcudbright	77	—	77	28	2	30
Lanark	10	—	10	7	—	7
Linlithgow	36	—	36	29	2	31
Midlothian	17	5	22	21	7	28
Perth	45	16	61	53	25	78
Renfrew	12	20	32	6	9	15
Ross and Cromarty ...	—	—	—	13	10	23
Selkirk	3	—	3	—	2	2
Wigtown	4	—	4	4	1	5
Total, Scotland ...	271	83	354	274	83	357
Total, Great Britain	779	521	1300	671	397	1068

APPENDIX IX.

STATEMENT SHOWING THE COUNTIES IN WHICH LOCAL REPRESENTATIVES OF THE DISTRICT AGRICULTURAL ANALYSTS HAVE BEEN APPOINTED FOR THE PURPOSE OF TAKING SAMPLES UNDER THE FERTILISERS AND FEEDING STUFFS ACT, 1893, AND THE FEES PAYABLE FOR AN ANALYSIS UNDER THE ACT, AND FOR THE SERVICES OF THE ANALYST'S REPRESENTATIVE, RESPECTIVELY.

District of Agricultural Analyst.	Analyst's Local Representatives.	Fee payable by Purchaser for an Analysis.	Fee payable by Purchaser for Services of Analyst's Representative.
Anglesey	Superintendents, Inspectors, and Sergeants of Police.	1s.	Nil.
Bedford	None	7s.	...
Berks	None	7s.	...
Brecknock	None	1s. 3d.–10s.	...
Bucks	None	10s. 6d.	...
Cambridge	None	10s. full analysis. 5s. partial analysis	...
Cardigan	Superintendents and Sergeants of Police.	3s. 6d.	Nil.
Carmarthen ...	None	Free	...
Carnarvon	None	[illegible]	...
Chester	5 Weights and Measures Inspectors	5s.	Nil.
Cornwall	Superintendents and Sergeants of Police.	2s. 6d.	Nil.
Cumberland ...	None	5s.	...
Denbigh	None	1s.	...
Derby	Sanitary Inspector	2s. 6d.	Nil.
Devon	None	5s. full analysis, 2s. 6d. partial analysis.	...
Dorset	None	3s. 6d.	...
Durham	Weights and Measures Inspectors	2s. 6d.	Nil.
Essex	Superintendents and Inspectors of Police.	[illegible]	Nil.
Flint...	None	Under Revision.	
Glamorgan	Police Superintendents	[illegible]	Nil

LIST OF DISTRICT AGRICULTURAL ANALYSTS—*continued.*

ENGLAND AND WALES—*continued.*

County.	*Name of Analyst.*	*Address.*
Essex	Bernard Dyer, D.Sc., F.I.C., F.C.S.	17, Great Tower Street, London, E.C.
Flint	William Foulkes Lowe, F.I.C., F.C.S., A.R.S.M.	Assay Office, Chester.
Glamorgan	Clarence Arthur Seyler, B.Sc., F.I.C., F.C.S.	Technical Institute, Nelson Terrace, Swansea.
Gloucester	George Embrey, F.I.C., F.C.S.	County Laboratory, Brunswick Road, Gloucester.
Hants	Bernard Dyer, D.Sc., F.I.C., F.C.S.	17, Great Tower Street, E.C.
Hereford	John Hughes, F.I.C., F.C.S. ...	79, Mark Lane, London, E.C.
Herts	Bernard Dyer, D.Sc., F.I.C., F.C.S.	17, Great Tower Street, London, E.C.
Hunts	James West Knights, F.I.C., F.C.S.	County Laboratories, Tenison Road, Cambridge.
Isle of Ely	John Augustus Voelcker, M.A., Ph.D., B.Sc., F.I.C.	22, Tudor Street, London, E.C.
Isle of Wight ...	Otto Hehner, F.I.C., F.C.S. ...	11, Billiter Square, London, E.C.
Kent	Frederick James Lloyd, F.I.C., F.C.S.	Muscovy House, Trinity Square, London, E.C.
Lancaster	Walter Collingwood Williams, B.Sc., F.I.C., F.C.S.	30, Brownlow Street, Liverpool.
Leicester	Bernard Dyer, D.Sc., F.I.C., F.C.S.	17, Great Tower Street, London, E.C.
Lincoln (Holland) ...	E. Wightman Bell, F.C.S. ...	High Bridge, Spalding.
Lincoln (Kesteven)	Charles Edward Cassal, F.I.C., F.C.S.	Town Hall, Kensington, London, W.
Lincoln (Lindsey) ...	John Augustus Voelcker, M.A., Ph.D., B.Sc., F.I.C.	22, Tudor Street, London, E.C.
London	Frank Clowes, D.Sc., F.I.C., F.C.S.	County Hall, Spring Gardens, London, S.W.
Merioneth	John Alan Murray, B.Sc., F.C.S.	University College, Aberystwyth.
Middlesex	Edward John Bevan, F.I.C., F.C.S.	4, New Court, Lincoln's Inn, London, W.C.

STATEMENT SHOWING THE COUNTIES IN WHICH LOCAL REPRESENTATIVES, &c.—*continued*.

District of Agricultural Analyst.	Analyst's Local Representatives.	Fee payable by Purchaser for an Analysis.	Fee payable by Purchaser for Services of Analyst's Representative.
Suffolk (West) ...	**Superintendents and Inspectors of Police.**	5s. 3d.	10s. 6d. and expenses.
Surrey	**4 Weights and Measures Inspectors.**	5s. full analysis, 2s. 6d. partial analysis.	Nil.
Sussex (East) ...	**2 Weights and Measures Inspectors**	2s. 6d.	...
Sussex (West) ...	**Superintendents of Police.**	7s.	2s. 6d.
Warwick	**None**	5s. 3d.	...
Westmorland ...	**The Police**	2s. 6d.	Nil
Wilts	**26 private persons**	2s. 6d.	Nil.
Worcester	**21 Sub-Inspectors of Police.**	2s. 6d.	...
Yorks (E. Riding)	**None**	7s.	...
Yorks (N. Riding)	**None**	1s. 6d.–10s. 6d.	...
Aberdeen	**Farmers, 239**	2s. 6d.–5s.	Nil.
Argyll	**District Sanitary Inspectors.**	2s. 6d.	5s.
Banff	**Clerks to Parish Councils.**	5s. full analysis, 2s. 6d. partial analysis.	Nil.
Caithness	**None**	5s.	...
Dumbarton ...	**None**	7s. 6d.	...
Dumfries	**Police**	...	1s. extra.
Elgin or Moray ...	**5 private persons**	5s. full analysis, 2s. 6d. partial analysis.	Nil.
Fife	**None**	5s.	...
Forfar	**Several private persons.**	5s. full analysis, 2s. 6d. partial analyses.	Nil.
Haddington ...	**None**	12s. 6d. full analysis, 7s. 6d. partial analysis.	...
Inverness	**None**	3s.	...
Kincardine	**38 private persons**	5s. full analysis, 2s. 6d. partial analysis.	Nil.

STATEMENT SHOWING THE COUNTIES IN WHICH LOCAL REPRESENTATIVES, *&c.*—*continued.*

District of Agricultural Analyst.	Analyst's Local Representatives.	Fee payable by Purchaser for an Analysis.	Fee payable by Purchaser for Services of Analyst's Representative.
Kirkcudbright ...	44 members of Stewart's Farmers' Club.	5s.	Nil.
Lanark	...	5s. full analysis, 2s. 6d. partial analysis.	...
Linlithgow	None	10s. full analysis, 5s. partial analysis.	...
Midlothian	None	10s. full analysis, 5s. partial analysis.	...
Nairn	None	5s.	...
Peebles	None	5s. full analysis, 2s. 6d. partial analysis.	...
Perth	A number of private persons.	5s.	Nil.
Renfrew	...	...	...
Ross and Cromarty	None	5s. full analysis, 2s. 6d. partial analysis.	...
Roxburgh	None	2s. 6d.-5s.	...
Selkirk	None	1s.	...
Stirling	None	10s. full analysis, 5s. partial analysis.	...
Sutherland	Sanitary Inspector	5s. full analysis, 2s. 6d. partial analysis.	Nil.
Wigtown	Police	Nil	1s.

APPENDIX X.

FERTILISERS AND FEEDING STUFFS ACT, 1893.

LIST OF DISTRICT AGRICULTURAL ANALYSTS.

ENGLAND AND WALES.

County.	*Name of Analyst.*	*Address.*
Anglesey	William Foulkes Lowe, F.I.C., F.C.S., A.R.S.M.	Assay Office, Chester.
Bedford	Bernard Dyer, D.Sc., F.I.C., F.C.S.	17, Great Tower Street, London, E.C.
Berks	John Augustus Voelcker, M.A., Ph.D., B.Sc., F.I.C.	22, Tudor Street, London, E.C.
Brecknock	John Alan Murray, B.Sc., F.C.S.	University College, Aberystwyth.
Bucks	John Augustus Voelcker, M.A., Ph.D., B.Sc., F.I.C.	22, Tudor Street, London, E.C.
Cambridge	James West Knights, F.I.C., F.C.S.	County Laboratories, Tenison Road, Cambridge.
Cardigan	John Alan Murray, B.Sc., F.C.S.	University College, Aberystwyth.
Carmarthen	John Alan Murray, B.Sc., F.C.S.	University College, Aberystwyth.
Carnarvon	Frederick Victor Dupré, A.R.C.S.	Devon County Agricultural Laboratory, 59 Queen Street, Exeter.
Chester	Joseph Carter Bell, F.I.C., F.C.S., A.R.S.M.	The Cliffe, Higher Broughton, Manchester.
Cornwall	Bernard Dyer, D.Sc., F.I.C., F.C.S.	17, Great Tower Street, London, E.C.
Cumberland	Robert Hellon, Ph.D., F.I.C., F.C.S., A.R.S.M.	The County Analyst's Laboratory, Whitehaven.
Denbigh	William Foulkes Lowe, F.I.C., F.C.S., A.R.S.M.	Assay Office, Chester.
Derby	John White, F.I.C.	County Offices, St. Mary's Gate, Derby.
Devon	Frederick James Lloyd, F.I.C., F.C.S.	Muscovy House, Trinity Square, London, E.C.
Dorset	Albert Edward Bell, F.I.C., F.C.S.	59, Trinity Square, Borough, London, S.E.
Durham	Alfred Charles Wilson, F.R.S.E., F.C.S.	Borough Hall, Stockton-on-Tees.

LIST OF DISTRICT AGRICULTURAL ANALYSTS—*continued.*

ENGLAND AND WALES—*continued.*

County.	*Name of Analyst.*	*Address.*
Essex...	Bernard Dyer, D.Sc., F.I.C., F.C.S.	17, Great Tower Street, London, E.C.
Flint	William Foulkes Lowe, F.I.C., F.C.S., A.R.S.M.	Assay Office, Chester.
Glamorgan	Clarence Arthur Seyler, B.Sc., F.I.C., F.C.S.	Technical Institute, Nelson Terrace, Swansea.
Gloucester	George Embrey, F.I.C., F.C.S.	County Laboratory, Brunswick Road, Gloucester.
Hants	Bernard Dyer, D.Sc., F.I.C., F.C.S.	17, Great Tower Street, E.C.
Hereford	John Hughes, F.I C., F.C.S. ...	79, Mark Lane, London, E.C.
Herts	Bernard Dyer, D.Sc., F.I.C., F.C.S.	17, Great Tower Street, London, E.C.
Hunts	James West Knights, F.I.C., F.C.S.	County Laboratories, Tenison Road, Cambridge.
Isle of Ely	John Augustus Voelcker, M.A., Ph.D., B.Sc., F.I.C.	22, Tudor Street, London, E.C.
Isle of Wight ...	Otto Hehner, F.I.C., F.C.S. ...	11, Billiter Square, London, E.C.
Kent	Frederick James Lloyd, F.I.C., F.C.S.	Muscovy House, Trinity Square, London, E.C.
Lancaster	Walter Collingwood Williams, B.Sc., F.I.C., F.C.S.	30, Brownlow Street, Liverpool.
Leicester	Bernard Dyer, D.Sc., F.I.C., F.C.S.	17, Great Tower Street, London, E.C.
Lincoln (Holland) ...	E. Wightman Bell, F.C.S. ...	High Bridge, Spalding.
Lincoln (Kesteven)	Charles Edward Cassal, F.I.C., F.C.S.	Town Hall, Kensington, London, W.
Lincoln (Lindsey) ...	John Augustus Voelcker, M.A., Ph.D., B.Sc., F.I.C.	22, Tudor Street, London, E.C .
London	Frank Clowes, D.Sc., F.I.C., F.C.S.	County Hall, Spring Gardens, London, S.W.
Merioneth	John Alan Murray, B.Sc., F.C.S.	University College, Aberystwyth.
Middlesex	Edward John Bevan, F.I.C., F.C.S.	4, New Court, Lincoln's Inn, London, W.C.

County.	*Name of Analyst.*	*Address.*
Monmouth	George Rudd Thompson, F.C.S.	69, Dock Street, Newport, Mon.
Montgomery ...	John Alan Murray, B.Sc., F.C.S.	University College, Aberystwyth.
Norfolk	Francis Sutton, F.I.C., F.C.S.	County Laboratory, Redwell Street, Norwich.
Northampton ...	Edward William Voelcker, F.I.C., A.R.S.M.	22, Tudor Street, London, E.C.
Northumberland ...	John Augustus Voelcker, M.A., Ph.D., B.Sc., F.I.C.	22, Tudor Street, London E.C.
Notts	John Golding, F.I.C., F.C.S. ...	Midland Agricultural and Dairy Institute, Kingston, Derby.
Oxford	Walter William Fisher, M.A., F.I.C., F.C.S.	5, St. Margaret's Road, Oxford.
Pembroke	John Alan Murray, B.Sc., F.C.S.	University College, Aberystwyth.
Peterborough, Soke of	Arthur Bower Griffiths, Ph.D., F.C.S., F.R.S.E.	171, Brixton Road, London, S.W.
Radnor	John Alan Murray, B.Sc., F.C.S.	University College, Aberystwyth.
Rutland	Bernard Dyer, D.Sc., F.I.C., F.C.S.	17, Great Tower Street, London, E.C.
Salop	Thomas Porter Blunt, M.A., F.I.C., F.C.S.	The Wyle Cop, Shrewsbury.
Somerset	Frederick James Lloyd, F.I.C., F.C.S.	Muscovy House, Trinity Square, London, E.C.
Stafford	Edward William Taylor Jones, F.I.C., F.C.S.	19, Victoria Street, Wolverhampton.
Suffolk, East ...	Alfred Sibson, F.C.S.	23, St. Mary Axe, London, E.C.
Suffolk, West ...	Bernard Dyer, D.Sc., F.I.C., F.C.S.	17, Great Tower Street, London, E.C.
Surrey	Frederick James Lloyd, F.I.C., F.C.S.	Muscovy House, Trinity Square, London, E.C.
Sussex, East... ...	Samuel Allinson Woodhead, B.Sc., F.I.C., F.C.S.	Agricultural College, Uckfield.

LIST OF DISTRICT AGRICULTURAL ANALYSTS—*continued.*

ENGLAND AND WALES—*continued.*

County.	*Name of Analyst.*	*Address.*
Sussex, West	Otto Hehner, F.I.C., F.C.S.	11, Billiter Square, London, E.C.
Warwick	Alfred Bostock Hill, M.D., F.I.C.	14, Temple Street, Birmingham.
Westmorland	Alfred Smetham, F.I.C., F.C.S.	16, Brunswick Street, Liverpool.
Wilts	John May Herbert Munro, D.Sc., F.I.C., F.C.S.	133, Kennington Road, London, S.E.
Worcester	Cecil Cooke Duncan, F.I.C., F.C.S.	The Shire Hall, Worcester.
York (East Riding)	John Augustus Voelcker, M.A., Ph.D., B.Sc., F.I.C.	22, Tudor Street, London, E.C.
York (North Riding)	Thomas Fairley, F.R.S.E., F.I.C., F.C.S.	17, East Parade, Leeds.
York (West Riding)	Thomas Fairley, F.R.S.E., F.I.C., F.C.S.	17, East Parade, Leeds.
County Boroughs.		
Bristol	Frederick Wallis Stoddart, F.I.C., F.C.S.	Western Counties Laboratory, Bristol.
Canterbury	Sidney Harvey, F.I.C., F.C.S.	South Eastern Laboratory, Canterbury.
Chester	William Foulkes Lowe, F.I.C., F.C.S., A.R.S.M.	Assay Office, Chester.
Croydon	Lester Reed, F.I.C., F.C.S.	19, South Park, Hill Road, Croydon.
Dudley	Harry Silvester, F.I.C., B.Sc.	36, Paradise Street, Birmingham.
Hanley	James Baynes, Ph.D., F.I.C., F.C.S.	Royal Chambers, Scale Lane, Hull.
Liverpool	Walter Collingwood Williams, B.Sc., F.I.C., F.C.S.	30, Brownlow Street, Liverpool.

List of District Agricultural Analysts—*continued.*

England and Wales—*continued.*

County Boroughs.	*Name of Analyst.*	*Address.*
Middlesbrough	John Edward Stead, F.I.C., F.C.S.	Laboratory and Assay Office, Middlesbrough.
Newport (Mon.)	George Rudd Thompson, F.C.S.	69, Dock Street, Newport, Mon.
Nottingham	Samuel Russell Trotman, M.A., F.I.C.	City Laboratory, King's Walk, Nottingham.
Salford	Joseph Carter Bell, F.I.C., F.C.S., A.R.S.M.	The Cliffe, Higher Broughton, Manchester.
Walsall	Edward William Taylor Jones, F.I.C., F.C.S.	10, Victoria Street, Wolverhampton.
Wolverhampton	Edward William Taylor Jones, F.I.C., F.C.S.	10, Victoria Street, Wolverhampton.

Scotland.

Aberdeen	James Hendrick, B.Sc., F.I.C., F.C.S.	Marischal College, Aberdeen.
Argyll	John William Biggart, F.I.C., F.C.S.	29, Cathcart Street, Greenock.
Ayr	John William Biggart, F.I.C., F.C.S.	29, Cathcart Street, Greenock.
Banff	John Hunter, F.I.C., F.C.S.	37, Chambers Street, Edinburgh
Berwick	John Hunter, F.I.C., F.C.S.	37, Chambers Street, Edinburgh.
Bute	John William Biggart, F.I.C., F.C.S.	29, Cathcart Street, Greenock.
Caithness	John Hunter, F.I.C., F.C.S.	37, Chambers Street, Edinburgh.
Clackmannan	John Hunter, F.I.C., F.C.S.	37, Chambers Street, Edinburgh.
Dumfries	James Davidson, F.I.C.	119, Irish Street, Dumfries.
Dunbarton	Robert Rattray Tatlock, F.I.C., F.C.S., F.R.S.E.	156, Bath Street, Glasgow.

LIST OF DISTRICT AGRICULTURAL ANALYSTS—*continued.*

SCOTLAND—*continued.*

County.	*Name of Analyst.*	*Address.*
Elgin or Moray ...	John Falconer King, F.I.C., F.C.S.	Minto House, Edinburgh.
Fife	George Duncan Macdougald, F.I.C.	Laboratory of City Analyst, Dundee.
Forfar	George Duncan Macdougald, F.I.C.	Laboratory of City Analyst, Dundee.
Haddington	Andrew Peebles Aitken, D.Sc.	8, Clyde Street, Edinburgh.
Inverness	John Falconer King, F.I.C., F.C.S.	Minto House, Edinburgh.
Kincardine	George Duncan Macdougald, F.I.C.	Laboratory of City Analyst, Dundee.
Kinross	John Hunter, F.I.C., F.C.S. ...	37, Chambers Street, Edinburgh.
Kirkcudbright ...	James Davidson, F.I.C. ...	119, Irish Street, Dumfries.
Lanark	Robert Rattray Tatlock, F.R.S.E., F.I.C., F.C.S.	156, Bath Street, Glasgow.
Linlithgow	John Hunter, F.I.C., F.C.S. ...	37, Chambers Street, Edinburgh.
Midlothian	John Hunter, F.I.C., F.C.S. ...	37, Chambers Street, Edinburgh.
Nairn...	Andrew Peebles Aitken, D.Sc.	8, Clyde Street, Edinburgh.
Orkney	John Falconer King, F.I.C., F.C.S.	Minto House, Edinburgh.
Peebles	John Falconer King, F.I.C., F.C.S.	Minto House, Edinburgh.
Perth...	George Duncan Macdougald, F.I.C.	Laboratory of City Analyst, Dundee.
Renfrew	John Clark, Ph.D., F.I.C., F.C.S.	138, Bath Street, Glasgow.
Ross and Cromarty	Andrew Peebles Aitken, D.Sc.	8, Clyde Street, Edinburgh.
Roxburgh	John Falconer King, F.I.C., F.C.S.	Minto House, Edinburgh.
Selkirk	Martin Dechan, F.I.C., F.C.S.	Laboratory of Analyst, Hawick.
Shetland	John Falconer King, F.I.C., F.C.S.	Minto House, Edinburgh.

LIST OF DISTRICT AGRICULTURAL ANALYSTS—*continued.*

SCOTLAND—*continued.*

County.	*Name of Analyst.*	*Address.*
Stirling	**Andrew Wilson, F.I.C.** ...	10, Viewfield Street, Stirling.
Sutherland	**John Hunter, F.I.C., F.C.S.** ..	37, Chambers Street, Edinburgh.
Wigtown	**James Davidson, F.I.C.** ...	119, Irish Street, Dumfries.
Burgh.		
Greenock	**John William Biggart, F.I.C., F.C.S.**	29, Cathcart Street, Greenock.

APPENDIX XI.

Copy of Correspondence with the Board of Trade, and with the Hull and District Fruit Buyers' Association with regard to alleged Preferential Rates charged by Railway Companies on the carriage of Fruit and Vegetables from the Continent, *viâ* Hull, to certain inland towns in this country.

1.

From the Secretary, Board of Agriculture, to the Secretary, Board of Trade,

"June, 18th, 1902.

"SIR,—I am directed by the President of the Board of Agriculture to inform you that representations have been addressed to him by the Hull and District Fruit Buyers' Association, Limited, with regard to the disadvantages suffered by the Hull vegetable and fruit trade owing to the action of the railway companies.

"It is alleged in the first place, that preferential treatment is accorded by railway companies to consignments of fruit and vegetables despatched from the Continent, *viâ* Hull, to inland towns in this country. It appears, for example, that the through rate for onions in 4-ton lots from Rotterdam to Nottingham is 16*s*. a ton, including wharfage and labour in Hull, which must amount to about 1*s*., whereas if the onions are sent in the first instance to a Hull merchant, who afterwards forwards them, in the same crates and without breaking bulk, to Nottingham, the cost will amount to 20*s*. per ton, and will include the following charges:—

Rate.	Per ton.	
	s.	*d.*
Rate for any quantity of onions from Rotterdam to Hull	8	6
Rate for onions, in 4-ton lots, from Hull to Nottingham...	10	0
Wharfage	0	6
Labour	1	0

"Complaint is also made of the great delay in the conveyance of produce by goods trains, whereby produce put on rail at Hull, to be delivered in Liverpool or Manchester, arrives at its destination later than consignments despatched to these towns at the same time from London.

"The Association further represent that, while the canals would, in many instances, prove serviceable for the conveyance of vegetables and fruit, consignors are debarred from utilising these channels of distribution owing to the existence of agreements between the canal companies and the railway companies which bind the former to maintain their rates at what is practically a non-competitive scale as compared with the railway rates.

"With reference to the foregoing points, Mr. Hanbury desires me to say that he understands that if the railway companies own lines of steamships they must, in certain cases at any rate, distinguish the sea from the land charges; and that he would be glad to learn (1) whether such an obligation is imposed upon all railway companies by a general statute, or whether it is to be found only in the private Acts of particular companies; and (2) whether, in cases where this requirement exists, the railway company is only bound to show the land and sea charges separately when requested by the payer of the charges to do so.

"Mr. Hanbury also wishes me to enquire whether, in cases where the railway company does not own any ships, but charges a through rate from foreign ports, the company is bound to make the same charge in respect of the land transit as if the goods had started from the British port and there had been no carriage by sea at all.

"With regard to the alleged agreements between the railway and canal companies in the neighbourhood of Hull, Mr. Hanbury would be glad to know whether the Board of Trade have any official knowledge of any such arrangements.

"I am, Sir,
"Your obedient servant,
"(Signed) T. H. Elliott,
"Secretary."

II.

From the Secretary, Board of Trade, to the Secretary, Board of Agriculture.

"25th June, 1902.

"Sir,—In reply to your letter of the 18th instant on the subject of a complaint made against the railway companies by the Hull and District Fruit Buyers' Association, Limited, I am directed by the Board of Trade to state that under the provisions of Sections 14 and 33 (5) of the Railway and Canal Traffic Acts, 1873 and 1888, respectively, railway companies which carry merchandise partly by land and partly by sea are bound to specify in the rate books kept at the ports in the United Kingdom which they use the proportion of any through rate appropriated to conveyance by sea, and that these books can be inspected by any person during all reasonable hours without the payment of a fee.

"With regard to the other points on which Mr. Hanbury desires information, I am to point out that, under the provisions of Sub-section (2) of Section 27 of the Railway and Canal Traffic Act, 1888, no railway company may make any difference in the tolls, rates, or charges made for, or any difference in the treatment of, home and foreign merchandise for the same or similar services; and I am to add that the Board of Trade have no knowledge of any such arrangements between railway and canal companies as are referred to in your letter.

"I am, Sir,
"Your obedient servant,
"(Signed) Francis J. Hopwood."

III.

From the Secretary, Board of Agriculture, to Richard Lewis, Esq., Hon. Secretary, Hull and District Fruit Buyers' Association.

"14th August, 1902.

"SIR,—I am directed by the Board of Agriculture to advert to your letter of May 9th last, and to say that they have been in communication with the Board of Trade upon the subjects referred to therein, and in the subsequent interview which took place between an Inspector of this Board and a member of your Association.

"With regard to the alleged preferential treatment by railway companies of consignments of fruit and vegetables despatched from the Continent, *via* Hull, to inland towns in this country, the Board are informed that, under Section 27, Sub-section 2, of the Railway and Canal Traffic Act, 1888, no railway company may make any difference in the tolls, rates, or charges made for, or any difference in the treatment of, home and foreign merchandise for the same or similar services; and that under the provisions 'of Sections 14 and 33 (5) of the Railway and Canal Traffic Acts, 1873 and 1888, respectively, railway companies which carry merchandise partly by land and partly by sea are bound to specify in the rate books kept at the ports in the United Kingdom which they use the proportion of any through rate appropriated to conveyance by sea, and that these books can be inspected by any person during all reasonable hours without the payment of a fee.'

"The Board are further informed that the Board of Trade have no knowledge of the existence of any agreements between the railway and canal companies whereby the latter are bound to maintain their charges for the carriage of produce at what is practically a non-competitive level as compared with the railway rates.

"I am to add that the Board have no objection to your giving such publicity to this letter as you may consider desirable.

"I am, Sir,

"Your obedient servant,

"(Signed) T. H. ELLIOTT,

"Secretary."

APPENDIX XII.

Copy of Correspondence between the Board of Agriculture and the Central Association of Dairy Farmers with regard to the stamping of railway milk churns for the purposes of the Weights and Measures Acts.

I.

From Honorary Secretary, Central Association of Dairy Farmers, to Secretary, Board of Agriculture.

Bank Passage, Stafford,
April 7th, 1902.

DEAR SIR,

I beg to enclose copy of a resolution passed by this Association at a recent meeting, and to express the hope that it may receive your favourable consideration.

I am, &c.,

EDWIN SMITHELLS.

Enclosure.

Resolution passed at the annual meeting held at Birmingham on March 6th, 1902 :—

"That, in view of the occasional prosecution of a farmer for using a railway milk churn which is not officially stamped and which is not correctly gauged, the Association is of opinion that railway milk churns should be exempt from the regulations imposed by the Weights and Measures Act. This Association is convinced that, subject as these churns are to the exceedingly rough usage by the railway companies, it is impossible for them to remain accurate measures. Only a small proportion of the churns in use are stamped with the stamp of verification ; most authorities recognise the unreasonableness of enforcing the Act in regard to them, but until some alteration is made in the law farmers will always be liable to vexatious prosecutions under the Act.

"This Association, therefore, requests that the Board of Agriculture will give the matter its most careful consideration, with a view to place the farmers in a more satisfactory position with regard to it, while in no way prejudicially affecting the interests of the general public."

(No. 3.)

Publications of Departmental Committees of the Board of Agriculture.

Title of Publication.	Price.		Parliamentary Number.
	s.	*d.*	
Swine Fever, Report 1893	0	1	C. 6999
Ditto Minutes of Evidence 1893	2	3	C. 6999—I.
Ditto (Pathology, &c.) Report 1896	0	6	C. 8023
Ditto Second Report 1897	0	3	C. 8372
Laws Relating to Dogs, Report 1897	0	2	C. 8320
Ditto Minutes of Evidence ... 1897	1	9	C. 8378
Transit of Animals carried coastwise, Report ... 1894	0	3	C. 7511
Ditto Minutes of Evidence ... 1894	2	0	C. 7511—I.
Inland Transit of Cattle, Report 1898	0	3½	C. 8928
Ditto Minutes of Evidence ... 1898	2	3	C. 8929
Glanders, Report 1899	0	2	C. 9397
Ditto Minutes of Evidence 1899	0	11	C. 9398
Ditto Report (Experiments) 1902	0	2½	Cd. 1396
Field Voles in Scotland, Report and Evidence ... 1893	1	4	C. 6943
Universities and College Estates Acts, Report ... 1897	0	1½	C. 8646
Ditto Minutes of Evidence... 1897	0	7½	C. 8647
Adulteration of Artificial Manures, Report and Evidence 1892	1	6	C. 6742
Ordnance Survey, Present Condition, Report ... 1893	0	4½	C. 6895
Ditto Minutes of Evidence ... 1893	2	3	C. 6895—I.
Ditto Copy of Board's Minute 1893	0	2	C. 7257
Ordnance Survey Maps, Sale and Distribution, Report 1896	0	1½	C. 8147
Ditto Minutes of Evidence... 1896	0	9	C. 8148
Ditto Copy of Contracts, &c. 1897	0	2	C. 8488
Milk and Cream Regulations, Report 1901	0	7½	Cd. 491
Ditto Minutes of Evidence 1901	3	8	Cd. 484
Agricultural Seeds, Report 1901	0	2	Cd. 489
Ditto Minutes of Evidence 1901	2	0	Cd. 493

APPENDIX XIII.

Testing of Babcock Apparatus.

Regulations.

The Committee of the National Physical Laboratory are prepared to receive for the purpose of verification the pipettes, measuring glasses, and test bottles used in the Babcock method of testing milk.

The apparatus to be tested should be sent, securely packed, to the Director, The National Physical Laboratory, Old Deer Park, Richmond. The carriage to and fro must be paid by the sender. A letter of advice must accompany all instruments sent for verification, which should contain the maker's name, a description of the instruments sent, and full directions for their return.

Great care is taken at the Laboratory to guard against loss or injury, but it is to be understood that all risks attendant on transit and safe custody are assumed by the persons who send the instruments.

In the Babcock test bottles the space between two consecutive graduations on the stem is supposed to contain ·04 c.cm The graduations will be tested at five points, and the bottle will be stamped as correct provided (1) the error at no point amounts to more than ·01 c.cm. and (2) the difference between the errors at no two points amounts to ·02 c.cm.

In the milk pipettes to hold 17·6 c.cm. an error of ·05 c.cm. will be allowed. For other pipettes the same proportionate degree of accuracy will be required.

The measuring glasses will be tested at 4 points, and the greatest permissible error will be ·25 per cent. of the nominal contents.

Fees.

For a single pipette	3*d*.
For a single test bottle	6*d*.
For a single measuring glass...	6*d*.

In the case of instruments which fail to pass the test, half fees will be charged.

All accounts are rendered quarterly.

If more than 100 instruments of the same pattern, tested during any quarter for a single firm or individual, are stamped as correct, then a discount of 10 per cent. will be allowed from the fees, provided the account is settled within two months of the quarter day on which it is due.

Every piece of apparatus which has passed the test will be marked with an official stamp.

APPENDIX XIV.

(No. 1.)

Publications of the Board of Agriculture.

Title of Publication.	Price.		Parliamentary Number.
	s.	d.	
Annual Reports:—			
Agricultural Returns of Great Britain comprising Acreage and Produce of Crops, Number of Live Stock, Prices of Corn and Meat, Agricultural Imports and Statistics of Colonial and Foreign Agriculture 1901	1	3	Cd. 1121
Proceedings under the Diseases of Animals Acts, the Markets and Fairs (Weighing of Cattle) Acts, &c. (with coloured plates) 1902	0	11	Cd. 1520
Proceedings under Inclosure, Tithe, Drainage, Copyhold, and other Acts 1902	0	8	Cd. 1519
Distribution of Grants for Agricultural Education and Research in Great Britain ... 1901–02	0	6½	Cd. 1242
Progress of the Ordnance Survey... ... 1901–02	4	4	Cd. 1243
Proceedings under the Sale of Food and Drugs Acts, and other Acts 1902	0	5	Cd. 1611
Other Reports:—			
Allotments and Small Holdings, Return .. 1890	2	6	C. 6144
Agricultural Holdings in Great Britain, Return of Number and Size in 1895 1896	0	4½	C. 8243
Small Holdings Act, 1892, Return of Land acquired under 1895	0	3	H.C. 407, Sess. 2.
Insects and Fungi injurious to Crops (with coloured plates) 1892	2	0	Departmental Paper.
Potato Disease Experiments 1892	0	9	C. 6647
Do. do. 1893	0	5½	C. 7138
Rust or Mildew on Wheat Plants (with coloured plates) 1893	0	9	C. 7018
Dairy Farming in Denmark, Germany, and Sweden 1892	0	6	C. 7019
Agricultural Experiment Stations of the United States 1895	0	4	C. 7699
Investigations into Cheddar Cheese Making ... 1899	1	7	C. 9374
Diseases of Animals Acts, Handbook 1899	1	6	Departmental Paper.
Dutch Brined Vegetable Industry 1902	0	8	Cd. 1368

(No. 2.)

Leaflets Issued by the Board of Agriculture.

(a.) Leaflets dealing with Insects and Fungi injurious to Crops.

No.	Title.	No.	Title.
1	Black Currant Mite.	38	Carrot Fly.
2	Vine, Plum, Hop, and Raspberry Weevils.	41	Red Spider.
3	Turnip Fly or Flea.	46	Stem Eelworm.
4	Caterpillars on Fruit Trees.	47	Asparagus Beetle.
5	Mangold Fly.	48	Pea and Bean Thrips.
10	Wireworms.	49	Fruit Tree Beetle.
11	Daddy Longlegs or Crane Fly.	52	Gooseberry Mildew.
12	Gooseberry Saw Fly.	53	Pear Midge.
14	Raspberry Moth.	56	Canker Fungus.
15	Apple Blossom Weevil.	60	Wood Leopard Moth.
16	Apple Sucker.	62	Pear and Cherry Saw Fly.
19	Pea and Bean Weevil.	64	White Root Rot.
20	Magpie Moth.	65	Small Ermine Moths.
22	Diamond Back Moth.	68	Currant Aphides.
23	Potato Disease.	69	Tent Caterpillars.
24	Ribbon Footed Corn Fly.	70	Winter Washing of Fruit Trees.
25	Chafer-beetles or White-grubs.	75	Root-knot Eelworm in Cucumbers and Tomatoes.
30	Codling Moth.	76	Cucumber and Melon Leaf Blotch.
31	Onion Fly.	77	Finger-and-Toe in Turnips.
33	Surface Caterpillars.	86	Brown Rot of Fruit.
34	Woolly Aphis or Apple Root Louse.	87	A Fungus Disease of Young Fruit Trees.
35	Celery Fly.		

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40	Kestrel or Wind-hover.	50	Water Wagtails or "Dish-washers."
42	Short-Eared Owl.	51	White or Barn Owl.
43	Titmice.	54	Spotted Flycatcher.
44	Common Lapwing, Plover, or Peewit.	55	Swallow.
45	Starling.	84	The House Sparrow.

(c.) Leaflets dealing with Farm Animals, including Poultry.

13	Acorn Poisoning.	61	Sheep Scab.
21	Warble Fly.	67	Favus in Poultry.
28	Anthrax.	78	Liver Disease of Poultry.
29	Swine Fever.	81	A Substitute for Dishorning.
57	External Parasites of Poultry.	82	Preparation of Wool for Market.
58	Internal Parasites of Poultry.	83	Preservation of Eggs.

(d.) Leaflets relating to Acts of Parliament.

8	Farmers and Assessments to Local Rates.	27	Remission of Tithe Rentcharge.
18	Fertilisers and Feeding Stuffs Act.	39	Assessment to Land Tax.
26	Farmers and the Income Tax.	66	Workmen's Compensation Act, 1900.

(e.) Leaflets dealing with Miscellaneous Subjects.

6	Voles and their Enemies.	73	Cultivation of Maize for Fodder.
9	Ensilage.	74	Purchase of Feeding Stuffs.
32	Foul Brood or Bee Pest.	79	Rations for Farm Stock.
36	Cultivation of Osiers.	80	Use of Artificial Manures.
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72	Purchase of Artificial Manures.		

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COMMITTEE ON BUTTER REGULATIONS.

FINAL REPORT

OF THE

DEPARTMENTAL COMMITTEE

APPOINTED BY THE

BOARD OF AGRICULTURE

AND

The Department of Agriculture and other Industries and Technical Instruction for Ireland,

TO INQUIRE AND REPORT UPON THE DESIRABILITY OF

REGULATIONS,

Under Section 4 *of the Sale of Food and Drugs Act*, 1899,

FOR

BUTTER,

WITH

COPY OF THE MINUTE APPOINTING THE COMMITTEE.

Presented to both Houses of Parliament by Command of His Majesty.

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1903.

[Cd. 1749.] *Price 3d.*

BUTTER REGULATIONS COMMITTEE.

MINUTE OF APPOINTMENT.

Joint Minute by the Rt. Hon. Robert William Hanbury, M.P., President of the Board of Agriculture, and the Rt. Hon. Horace Curzon Plunkett, Vice-President of the Department of Agriculture and other Industries, and Technical Instruction for Ireland, constituting a Departmental Committee.

We hereby appoint a Committee to enquire and report as to what regulations, if any, may with advantage be made under Section 4 of the Sale of Food and Drugs Act, 1899, for determining what deficiency in any of the normal constituents of butter, or what addition of extraneous matter, or proportion of water in any sample of butter shall, for the purpose of the Sale of Food and Drugs Acts, raise a presumption, until the contrary is proved, that the butter is not genuine.

The Committee will consist of the following gentlemen, viz. :—

Rt. Hon. Horace Curzon Plunkett, Chairman.

Sir Charles Alexander Cameron, C.B., M.D., Medical Officer of Health and Public Analyst for Dublin.

Professor Thomas Edward Thorpe, C.B., LL.D., F.R.S., Principal Chemist of the Government Laboratories.

Major Patrick George Craigie, an Assistant Secretary of the Board of Agriculture.

Mr. Robert Andrew Anderson, Secretary of the Irish Agricultural Organisation Society.

Mr. Christopher Dunn, J.P., Chairman of the Trustees of the Cork Butter Market.

Mr. George Gibbons.

Mr. John Gilchrist.

Mr. Hudson Ewbanke Kearley, M.P., and

Professor John Millar Thomson, LL.D., F.R.S., President of the Institute of Chemistry.

Mr. Arthur Edwin Balleine, of the Board of Agriculture will act as the Secretary to the Committee.

R. W. HANBURY,
President of the Board of Agriculture.

HORACE PLUNKETT,
Vice-President of the Department of Agriculture and other Industries, and Technical Instruction for Ireland.

3rd July 1901.

We hereby appoint Mr. Patrick Hickey, of 8, Fennel Street, Manchester, to be an additional member of the Departmental Committee appointed by our Joint Minute of the 3rd inst.

R. W. HANBURY,
President of the Board of Agriculture.

HORACE PLUNKETT,
Vice-President of the Department of Agriculture and other Industries, and Technical Instruction for Ireland.

26th July 1901.

6569. 2000 Wt. 9159—12/03. Wy. & S.

BUTTER REGULATIONS COMMITTEE.

FINAL REPORT.

To the PRESIDENT of the BOARD of AGRICULTURE and FISHERIES, and to the VICE-PRESIDENT of the DEPARTMENT of AGRICULTURE and TECHNICAL INSTRUCTION for IRELAND.

Sirs,

1. The Departmental Committee appointed by Minute of the 3rd July 1901, to inquire and report as to what regulations, if any, may with advantage be made under Section 4 of the Sale of Food and Drugs Act, 1899, for determining what deficiency in any of the normal constituents of butter, or what addition of extraneous matter or proportion of water in any sample of butter, shall, for the purposes of the Sale of Food and Drugs Acts, raise a presumption until the contrary is proved that the butter is not genuine, have already addressed to you an Interim Report* in which they unanimously recommended the adoption of a limit of 16 per cent. for the proportion of water in butter to be fixed by a Regulation under the above-named section of the Food and Drugs Act, 1899. In making this recommendation they were obliged to assume, after the legal evidence tendered to them, that, in the present state of the law, butter containing a larger amount of water than 16 per cent. would escape the operation of this limit, provided that a sufficient disclosure of the fact were made to the purchaser. Mead, 8258.

2. You have given immediate effect to this recommendation by causing Regulations† to be made and published limiting the amount of water in butter. It may be added that since the publication of their Interim Report the Committee have received information concerning the operation of the 6 per cent. limit which leads them to believe that the limitation has worked well in practice and has been of benefit to the trade, and that no practical hardship has been felt in conforming with the Regulation. The summer of 1902 was, however, favourable to the production of butter with a low percentage of water.

3. In the present Report the Committee deal with the results of their inquiries concerning the other matters referred to in the minute of appointment—*viz.*, as to what regulations, if any, might with advantage be made under the same section of the Sale of Food and Drugs Act, 1899, for determining what deficiency in any of the normal constituents of butter, or what addition of extraneous matter other than water, should raise a presumption until the contrary is proved that the butter is not genuine.

4. The question referred to the Committee in connection with this section of their inquiry practically resolved itself into this: What regulations, if any, should be framed for the purpose of directing an analyst appointed under the Sale of Food and Drugs Acts when to raise a presumption that a

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* [Cd 944.]

† "*Sale of Butter Regulations*, 1902."

sample of butter had been mixed with foreign fat? In seeking for an answer to this question the Committee have had to inquire into the chemical nature of butter, to ascertain how far the composition of butter-fat is dependent upon conditions of production, and within what limits it may vary. They have also had to inquire into the nature of the substances which may be used for the purpose of adulterating butter; and what methods are open to analysts to detect and determine the extent of such adulteration.

Poole Wilson, 1904–54.
Tichborne, 2406–18.
Sir C. Cameron, 2581–2, 2590–1.
Gissel, 3545–631.
Harrington, 4905–25.
Sinclair, 6258–9.
Cameron, 6314–7.

5. In pursuance of this portion of their inquiry the Committee have examined 26 witnesses, in addition to those mentioned in the Interim Report (para. 3) whose evidence was not restricted to the question of water in butter. The witnesses may be grouped as follows:—

Representatives of Countries exporting Butter to the United Kingdom, —*viz:*

Holland	2	Germany	2	
Norway	1	Sweden	1	
Denmark	1	Russia	1	
U.S. of America	1	France	1	
				10

Secretary of the Netherlands Chamber of Commerce in London		1
Analysts (not including representatives of foreign countries exporting butter) comprising:—		
Analysts to Dairy Associations and Companies	2	
Public Analysts appointed under the Sale of Food and Drugs Acts	9	
Superintending Analyst Government Laboratory	1	
		12
Magistrates		2
Inspector of the Board of Agriculture		1
		26

Richmond, 8869–8873.

Richmond, 8874–8885.

Richmond, 8916.
Allen, 9273.

6. Butter-fat, that is, butter freed from water, curd, salt, and extraneous matter, is, like the greater number of the natural fats, what is known in chemical terminology as a triglyceride—or rather, a mixture of triglycerides—that is, combinations of glycerin with certain substances of the nature of acids. Butter-fat is, however, sharply distinguished from the vast majority of the natural fats, and in particular from those substances which are or may be used to mix with butter, by the circumstance that a considerable proportion of its acids, when separated by chemical means from the glycerin, are readily soluble in water, or may be readily volatilised either alone or in a current of steam,* whereas the acids separated from the foreign fats are practically both insoluble and non-volatile. This fundamental difference serves at once to distinguish, for example, between butter and margarine (a preparation from suet or other fat, mixed with vegetable oils and coloured so as to resemble butter); and has been largely made use of by analysts, not

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* Strictly speaking, the terms "soluble" and "volatile," as applied to these acids obtained from butter, are not exactly interchangeable, as more of the acids may be volatilised in a current of steam than are soluble in water. In practice certain of these acids so volatilised are not determined by the analyst, since they are insoluble in water. As a matter of fact, the readily soluble acids are readily volatile: and when expressed as percentage amounts of the butter, and in the same terms, the difference between these amounts is inconsiderable.

only for this purpose, but also with a view of determining the relative amounts of butter and margarine in a mixture of these substances. It is the principle of the method prescribed and jointly adopted by the Society of Public Analysts and the Government Laboratory (Somerset House) to determine, with sufficient accuracy, the extent to which butter has been added to margarine, and to discover infractions of the law which forbids the addition of more than ten per cent. of butter fat to margarine.

Williams, 9400–9401.
Jones, 9570.
Hehner, 10119–10120.
Müntz, 12517, 12533–4.
Schedule to this Report, p. 27.

7. Other methods of discriminating between butter and margarine, and of detecting the admixture of margarine with butter, are known to analysts and are frequently employed by them. Thus some analysts, after liberating the acids from the glycerin, determine the amount of those which are insoluble in water, butter-fat furnishing on an average only about 88 per cent. of insoluble acids, whereas margarine usually affords upwards of 95 per cent. of insoluble acids. Other analysts ascertain the amount of alkali which will combine with the total acids which may be obtained from the butter, and thereby differentiate between butter-fat and the fats that may be used for admixture, since the foreign fats require less alkali for complete combination than butter-fat does. The relative density of the melted fat is also useful as a criterion, since a given volume of melted butter-fat at a known temperature weighs more than the same volume of margarine fat at the same temperature.

Richmond, 8916–8940, 8966–79.
Jones, 9570.
Hehner, 10119–20.
Lewin, 10562–6, 10695–9, 10776.
Stock, 11022.

8. It is also found that the refractive index of butter and that of margarine are sensibly different. Instruments have been constructed in which this principle is applied, and by which butter can at once be distinguished from margarine. Such instruments are now largely used, especially in Germany.

Richmond, 8982–9.
Allen, 9287.
Williams, 9450–64.
von Buchka, 10516–7.
Lewin, 10555–9, 10669.

9. There are other differences in the chemical and physical characters of butter and margarine which are at the service of the analyst, and which are occasionally made use of; such as the different appearances under the polarising microscope, and the different behaviour of solutions of butter and margarine in certain solvents. Margarine almost invariably contains a considerable amount of certain vegetable oils, and reactions are known to chemists whereby some of these oils can be detected with ease. The margarine is in fact "ear-marked" by the presence of the oils. The addition of margarine to butter might be detected with comparative readiness if it could be ensured that only oils admitting of certain detection were used in its manufacture, and that the characteristic component of such oils was not liable to be introduced into the butter through the agency of the oil-cake given to the cows.

Richmond, 8892–8915.
Allen, 9285–9.
Williams, 9526–41.
Jones, 9570–6.
von Buchka, 10534–8, 10541.
Vieth, 10540.
Lewin, 10616.
Müntz, 12579.

10. All the tests hitherto devised, whilst serving to distinguish with absolute certainty between butter and commercial margarine, break down to a greater or less extent when applied to the discovery of small quantities of foreign fat in butter—that is, quantities such as 5, 10, or 15 per cent. There is no difficulty as regards the manipulative processes: these are not affected by the nature of the substance to be tested. The difference arises in regard to the inference which is to be drawn from the results.

Richmond, 8966–7, 8976–80.
Allen, 9285–6.
Jones, 9560, 9580–1, 9603–5.
Hehner, 10121, 10153–4.
Dyer, 10231, 10242.
Lewin, 10557, 10560, 10737–8.
Stock, 11005, 11130–2.
Lloyd, 11455–8.

11. If butter-fat had a constant composition the difficulty would not occur. But butter-fat is not absolutely constant in composition, and the variations are sufficiently wide to render it occasionally very difficult if not impossible to establish the presumption, on the basis of a deficiency in the normal proportion of some one or other of its constituents, that the butter has been mixed with a small quantity of foreign fat. Observation has shown that the chemical nature of butter-fat is dependent to a certain

Richmond, 8991–9004, 9034–9.
Faber, 9901–2.
Lewin, 10718–9.
Vieth, 10921–7, 10969.
van der Zande, 9127–39.

Allen, 9273, 9287–8. Appendix XXVI. p. 497.

extent upon climatic conditions, period of lactation, nature and amount of food, breed, and idiosyncracy of the cow; and this variation in composition has a corresponding influence upon such of the physical characteristics of butter as are used by analysts to supplement their chemical tests.

van Rijn, 9226, 9253–5. Riple, 9730, 9798-9809. Faber, 9962. **Hehner**, 10126–47. **Lewin**, 10604–8. 10611–2. 10660–8, 10718–25. Müntz, 12561.

12. The Committee are advised that when cows are subjected to sudden alternations of temperature, and especially when they are kept out in the late autumn, exposed to wet and cold winds, the proportion of the volatile acids is sensibly diminished; but that when the weather becomes milder, or the cows are housed, the amount of these acids—which, it must be remembered, are the characteristic acids of butter as distinguished from other animal fats—usually becomes normal. As might be expected, butter coming from cold countries, or countries which are liable to great extremes of temperature, like Siberia, shows the greatest variations in this respect.

Richmond, 8992–9008. **van der Zande**, 9135–6. Riple, 9730. Faber, 9962–80. **Lewin**, 10608–10, 10640, 10733. **Wedin**, 11232.

13. It is further found that the period of lactation of the cow has a marked influence on the proportion of the volatile acids furnished by butter. In general, it appears that the amount of these acids reaches a maximum in from five to seven days after calving, after which the volatile acids gradually diminish until the close of the lactation period.

van der Zande, 9162–82. **van Rijn**, 9226, 9243–55.

14. The joint effect of these influences is well illustrated in the character of a certain amount of the Dutch butter produced in Friesland, Gröningen, and a few other provinces in the Netherlands, during the late autumn—say from the latter part of September to the middle or end of November. At that time of the year the cows throughout a great part of Holland are as a rule nearing the end of their lactation period, the weather is usually unsettled, the nights cold, and the pasturage scanty. The milk-fat produced under such conditions is frequently so low in volatile acids as to give rise to the supposition that the butter has been mixed with margarine. After the cows are stabled and in receipt of their usual winter food, the butter-fat usually re-acquires its normal complement of the characteristic fatty acids of butter. According to Dr. van Rijn, whose work on "The Composition of Dutch Butter" was brought to the knowledge of the Committee, and who appeared as one of the representatives from Holland, the abnormality in the composition of Frisian butter, due to the above-named causes, is not manifested, or at all events is not manifested to anything like the same extent, by butter from other parts of the Netherlands such as Limburg and North Brabant, where the cows as regards the influence of the weather are under much more favourable circumstances than the cows in the northern part of Holland.

van Rijn, 9256–9.

15. These observations have been confirmed by a French Commission appointed at the instance of the French Minister of Agriculture. From a large number of independent analyses made on authentic samples of butter collected from the chief butter-producing provinces of the Netherlands, the Commission have drawn the following conclusions:—

Bulletin du Ministère de l'Agriculture, Paris, 1901, p. 327.

(1). "Certain Dutch butters, in the months of October and November, show a composition sensibly different from that of French butters, and more or less similar to that possessed by butter mixed with margarine.

(2). This occurs only at a well-ascertained period of the year, and for about two and a-half months, viz.: from the middle of September to the end of November.

(3). It would be wrong to generalise this, as certain interested persons are apt to do, and to extend it to all the butter-output of the Low Countries. We find, in fact, that a large number of butters with normal composition are produced in the Netherlands even at the period indicated.

(4). The decrease in the proportion of volatile acids in certain butters is due to the defective conditions of existence in which the cows at pasture are placed. Whilst on the one hand they are suffering from the effects of exposure to cold and wet, on the other they are supplied with insufficient provender. It appears from the whole of our observations that it would be possible for Dutch butters to exhibit a normal composition during the whole year, if the herds were stabled at the first approach of cold weather and fed in a more suitable manner.

(5). The defective conditions under which the cows exist when they produce butter poor in volatile acids justify us in considering these products as *abnormal*. In fact if the chemist, confronted with butter poor in volatile acids, coming from Holland, and made during the months in question, cannot conscientiously certify that the butter has been adulterated by the addition of margarine, he has at least the right to declare that it is abnormal butter. He is even justified, in comparing it with the butter of our own country, in saying that in France such a product is not a marketable article."

16. That this condition of things is remediable is proved by the case of Denmark. As regards climate, Denmark is not more favourably situated than Friesland, and yet the proportion of so-called "abnormal" butters, due to cold weather and less substantial feeding, is considerably less than in Frisian butter. It is further minimised by the practice which prevails in Denmark of spreading the calving of the herds over the year, whereby the influence of the period of lactation is largely eliminated. Indeed, Denmark supplies a striking illustration of the manner in which modern and rational conditions of dairy procedure, which have for their primary object the manufacture of butter of high and uniform quality, tend to facilitate the settlement of the question which the Committee have to consider. Fifty years ago the general condition of the cows of Denmark was as wretched as that of any in Northern Europe; they were just kept alive during the winter and in the spring time. They were little more than skeletons, and then they calved.

Faber, 9973–6.

Faber, 10110–3.

17. All this has now changed, and within a comparatively limited period. "The farmers in Denmark," said Mr. Allen, who visited that country in 1888, "are looked after very paternally. They have the best of Government "advice, and competent officials are constantly going round literally to advise "them how best to conduct their dairies. That undoubtedly has done the "farmers a very great deal of good. The Danish Government, of course, "wish to avoid these abnormal samples, because there is always suspicion "attaching to them, and I have no doubt whatever that they have greatly "improved their butter in this way. As a matter of fact, I do not know "much about prices, but I believe at that time, 12 years ago, Danish butter "was about the lowest priced butter in the market, and now I believe it "commands a very good price." Not only does Danish butter "command a very good price," but Denmark furnishes upwards of four-tenths of the amount of butter received into this country. It was made quite clear to the Committee that no limit or standard based upon the presence of certain normal constituents of butter, which they were at all likely to recommend, would seriously interfere with the interests of Danish butter producers.

Allen, 9305.

Faber, 10091, 10099, 10035–8. 9955–7.

18. Russian, and more particularly Siberian, butter occupies a position somewhat similar to that occupied by Danish twelve or fifteen years ago. Owing to the construction of the Siberian Railway and to improvements in the means of storage and transit, the importation of Russian produce into this country has made very rapid strides within the last two or three years, and the returns show that Russia now takes rank as second among the countries supplying us with butter. Some portion of this butter is still of an indifferent quality; but thanks to the enlightened policy of the Government, which seeks to foster and develop the industry by the provision of competent instructors, the introduction of co-operative principles, skilled management, analytical control, and cheap transport, the character of the butter is asserted to be improving.

Kalantar, 12094, 12107.

Appendix, XXXII.

Kalantar, 12097–12100.

Kalantar, 12089 *et seq.*
Appendix. XXXII.
Kalantar, 12099-12100.
12129.
12134.
12150.
12147.
12157.
12216.
12239.
12248.

19. Mr. Kalantar, the "Chief Specialist" under the Russian Government in regard to butter analysis, gave an account of these steps, and laid before the Committee a considerable body of analytical evidence concerning the composition of Russian and Siberian butter, and the limits within which it is found to vary. Siberian butter, which constitutes above eight-tenths of the amount imported as Russian produce, is mainly produced in co-operative creameries owned by associations of farmers, the milk being bought from the peasants. The feeding of the cows is admitted to be unsatisfactory and capable of great improvement. The cows mainly calve during the first three months of the year, and towards the end of their lactation period are, in some cases, fed only on straw. Mr. Kalantar admitted that by better feeding and better protection the proportion of butter that would be affected by the imposition of a limit of, say, 24 Reichert-Wollny, would be lessened. Measures are now being taken by the Russian Government to secure that the cows shall be kept in warmer places in the winter, and shall be better fed. The principal reason why the butter is better in, say, the Government of Omsk, is because the stabling is better. In Mr. Kalantar's opinion it is very probable that when the improvement in the housing of cattle has become general the proportion of volatile acids in Russian butter will be the same on the average as those in the butter of Western Europe.

Riple, 9736, 9747, 9793-9815.
Riple, 9863-5.
Wedin, 11171-5, 11191-11203.

20. Norwegian, and in a smaller degree Swedish, butter is affected to some extent by the same adverse conditions that prevail in Friesland and in Siberia; but from economic causes much of the abnormal butter made in Norway is not exported to this country. Our import trade in butter with Sweden dates from 1864, and is not increasing. Above half of the exported butter is sent *viâ* Denmark, and of this nearly all comes to England.

21. So far as can be gleaned from the evidence laid before the Committee it is mainly Siberian, and to a smaller extent Dutch and Norwegian produce, that would be affected by any limit, based upon a deficiency in normal constituents, that would be recommended by your Committee. There is no evidence that American, Colonial, or Argentine butter, or the butter of France or Italy, would be affected to any sensible extent.

Kalantar, 12229-12231.
Faber, 10091, 10099, 10023.
Faber 10100*-1.

22. The representatives of Holland, Norway, and Russia, naturally deprecated the adoption of any limits that would prejudicially affect the commercial value of the produce of these countries. Mr. Kalantar was personally of opinion "that it would be a good thing to have a standard," but in the interests of his country he thought it impossible to fix an exact standard at the present moment. The representative of Denmark shared their opinion, not so much, as it appeared, in the interest of Danish producers, whom he admitted would scarcely be affected by any limit that was at all likely to be suggested, as in the interests of those Danish merchants who were concerned in the trade in Siberian or Russian butter.

Appendix XXIX, XXX.

23. The Committee have necessarily given consideration to the question as it affects butter produced in the United Kingdom. It appears, however, that the analytical evidence available as regards the variations in chemical composition of such butter is by no means so extensive as in the case of the chief continental butters. With a view of supplementing the existing information on this point a special inquiry has been carried out in the Government Laboratory at the instance of the Board of Agriculture. The main results of this inquiry, so far as it has hitherto proceeded, have been embodied in a report to the Committee, and are included in an Appendix to the Minutes of Evidence. Between 300 and 400 samples have been examined, but owing to the relatively short period over which the observations have extended and the comparatively small number of farms and dairies from which specimens have been procured, the evidence thus obtained has necessarily been less complete than has been accumulated in some other

countries. Moreover, since the places from which samples were procured were in several cases purposely selected with a view of affording information as to the influence exerted by particular conditions of production on the nature of the butter, the results as a whole cannot be expected to fully represent the general commercial character of British butter.

24. A knowledge of the conditions affecting the nature and composition of butter is of such great importance to the farmer, apart from its immediate bearing upon the question which the Committee were appointed to consider, that they are of opinion that the inquiry instituted by the Board of Agriculture should be resumed on an extended scale.

25. But whilst the Committee recognise that the information hitherto available as regards the butter of the United Kingdom is not as complete as might be desired, and gives no adequate presentment of the actual amount of variation which may be expected to occur in the butters of the United Kingdom, it does not seem to them that the evidence before them affords any reason for supposing that such butter is at all likely, as regards its content of volatile acids, to fall below that produced in the Colonies and in the greater number of continental countries. Thus, according to figures furnished by Mr. H. Droop Richmond of the Aylesbury Dairy Company Appendix XXI. about two per cent. of the English butters examined by him contained volatile acids in smaller proportion than would correspond to a Reichert-Wollny number of 24. Mr. E. W. T. Jones, the Public Analyst for Stafford, Jones, 9717. although in favour of a "tacit" standard as between the Government Laboratory and the analysts rather than an "official" standard to be instituted by the Board of Agriculture, considered that English farmers' butter would not be condemned once in a hundred times by such a limit. Mr. C. Estcourt, Public Analyst for Manchester, who favoured the fixing of Estcourt, 11764–5. a standard, stated that out of some hundreds of samples of English and Irish butter he had only found three instances where the volatile acids were lower than 24 (Reichert-Wollny). Relying on this evidence, and also bearing in mind the probability that butter made in this country forms only a relatively small proportion of that which ordinarily comes within the operation of the Sale of Food and Drugs Acts, the Committee see no reason to apprehend that any appreciable quantity of the commercial butter made in the United Kingdom will be prejudicially affected by any standard under which no serious proportion of imported butter would be excluded.

26. In view of the state of the Margarine Law in this country and in certain of the countries from which we receive butter, notably Holland, and after reviewing the wide variations of opinion advanced in evidence from various quarters, and in the light of the experience placed at their disposal by such of their colleagues as were in a position to offer advice on the scientific aspects of the problems before them; the Committee are of opinion that it is desirable to impose a limit which should determine, for the purposes of the Sale of Food and Drugs Act, 1899, when a deficiency in those constituents which specially characterise butter as a natural fat should raise a presumption that the butter is not genuine.

27. The frequent prosecutions under the Sale of Food and Drugs Acts in this country, and under the Margarine Act, 1887, prove that the present laws have not succeeded in preventing the substitution of margarine for butter by the retailer, or in stopping the illicit mixture of margarine with butter. Nor, in spite of recent amendments, is the condition of things more satisfactory in Holland. It was admitted by the Dutch representatives that van der Zande, 9184, 9196. it was a matter of common knowledge in Holland that butter from Brabant, where the majority of the margarine factories are, has been adulterated for years, and that butter is sold from Friesland to be taken to Brabant for the purpose of being mixed with margarine and shipped to this country as butter. Although the Netherlands Government had recently (1901) passed a new butter or margarine law for the better control of the butter

van der Zande, 9200–2.

trade, Dr. van der Zande expressed his personal opinion that it would be ineffectual in stopping this fraud.*

von Buchka, 10534–8.
Appendix XXXIV, XXXV.

28. The Committee have in addition made inquiry into the nature of the margarine laws in Germany, Denmark, Norway, Sweden, and Russia, and as to the steps which are taken to enforce them. Owing to the fact that all margarine manufactured in Germany must by law contain a certain proportion of sesamé oil, which is readily detected, even in small quantity, by chemical methods, a very great check has been given to the sophistication of butter by margarine in that country. Austria and Belgium have adopted the same procedure, and there is reason to believe the sale of adulterated butter in the latter country would have been largely stopped in consequence, if the Dutch margarine manufacturers had been legally compelled to "ear-mark" their products in this manner.

Faber, 9946–7, 10038.
Kalantar, 12113.
Kalantar, 12114–12121.
Kalantar, 12264, 12265.

29. As regards Denmark, the margarine law is so stringent, and the system of control and inspection, both of margarine and of butter factories, so rigorous, that the Committee are assured that the chance of Danish produce being mixed with margarine in Denmark is too remote to be worth consideration. As regards Russia, the Committee are informed that at present there are only two margarine factories in that country, viz., in Moscow and in Odessa; and, according to Mr. Kalantar, it is unlikely that any considerable quantity of margarine would find its way to Siberia, or to the provinces of European Russia concerned in the manufacture of butter. It is forbidden to colour margarine in Russia, or sell it in shops which deal in butter. Margarine is not allowed to be imported into Russia, and "mixtures" are not permitted.†

Riple, 9739–41, 9766–78

30. As regards Norway, the Committee have not the same assurances. Mr. Riple, the Agricultural Agent of the Norwegian Government in this

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* The following information, which has been supplied by the Foreign Office, is contained in the Provisional Report of the Netherlands House of Representatives on the Estimates for the year 1903:—In view of the frequent dishonest practices in the butter trade, the revision of the Butter Law was urged in several quarters. It was asserted that in one factory, in the course of two months, 7,770 kilos of margarine were sold as pure butter. Some members urged that margarine should be mixed with sesamé oil in order to facilitate the detection of fraud. Others were of opinion that the system of control should be stricter, not only as regards the finished product but also during its manufacture. It was mentioned that control stations would not prevent dishonest practices, because these stations only affect the persons who voluntarily make use of them. Certain members stated that in some provinces the inscription "Margarine" is placed over the outer door of factories, although the establishment passes for a butter factory. Moreover, this appears to have been done in some cases just when the butter-inspector visited the factory, and that even co-operative dairies appear to be guilty of such practices. An opinion was expressed as to the necessity of absolutely prohibiting the use of margarine and other such fats in butter factories, and to give officials power to control the preparation of goods in butter and margarine factories. The Government reply states that the proposals in the Provisional Report would involve a great extension of State interference in the butter trade, and that it would not be possible to stop at the control of butter factories. The same treatment would have to be extended to the margarine factories, because adulteration of butter can take place just as well in the latter as in the former, and the proposal to mix margarine with sesamé oil could not be enforced without a system of control. Nor would such comprehensive measures prevent dishonest practices of which there is no question, seeing that when once butter has left the factory and is put on the market its mixture with margarine remains possible and is frequently resorted to. The existing system, even though it does not yield entirely satisfactory results, must therefore be adhered to for the present. Moreover, the new law has been in operation for too short a period to form a final judgment on its working. Meanwhile praise is due to the efforts which are being made by mutual co-operation to guarantee the genuine quality of butter, and the establishment and development of private butter control stations are being followed by the authorities with deep interest.

† Since the date of Mr. Kalantar's evidence the Committee has received, through the Foreign Office, a Memorandum from H.M. Consul-General at St. Petersburg stating that, in spite of the law of the 20th April, 1901, the falsification of butter with margarine and other fats is practised on a large scale in Russia by dealers in the natural product. An analysis made in May last at St. Petersburg, in the Chemical Laboratory of the Municipality, showed that of 62 samples of butter exposed for sale, 16 proved to contain from 10 to 80 per cent. of foreign fatty substances. The adulteration of butter is stated to be carried on by some newly-established Siberian butter makers; also at St. Petersburg, but chiefly at Moscow where a margarine factory is in full activity. A similar establishment was at work for some time at St. Petersburg, but it has ceased operations owing to the bankruptcy of the firm (English) which conducted them. The *Journal de St. Petersbourg*, of the 24th May (6th June), 1903, states that similar products are received from Tobolsk, Tumene, Kaïnsk, Catherinebourg, and from the province of Vologda.

country, explained the provisions of the new margarine law recently passed by the Storthing, in which it is prohibited to make butter and margarine in the same building, or to make margarine in a building in which butter is collected or packed. There is, however, apparently no limit to the amount of butter which may be added to margarine, although it is expressly forbidden to adulterate butter with margarine. No indicative or "tell-tale" substance is used in the margarine, about 8,000 cwts. of which are yearly exported to this country.

Riple 9835–52.

31. Mr. Wedin, the Commissioner of the Swedish Board of Agriculture resident in this country, explained the margarine law of Sweden. It appeared to be practically similar to that of Denmark. The export of margarine to this country is, however, almost *nil*. In Mr. Wedin's opinion the probability that Swedish farmers could adulterate butter with margarine without risk of detection by the dairy inspectors is as remote as in Denmark.

Wedin, 11161–5, 11176–7, 11212–6.

32. The Committee, having decided to recommend a limit based on a deficiency in the normal constituents of butter, for the purposes of Section 4 of the Sale of Food and Drugs Act, 1899, had next to consider what, in their opinion, that limit should be, and how it should be determined. From the evidence before them it appeared that analysts were almost unanimous in recommending that if a limit were to be imposed, as to the expediency of which there was a considerable difference of opinion, it should be based upon a determination of what all were agreed in regarding as the characteristic constituents of butter-fat, namely, the volatile acids. That the proportion of volatile acids is by general consent by far the most important criterion in butter analysis will be evident from the whole body of the evidence. Originally suggested by Reichert as the foundation of a quantitative estimation, the process has been worked out by the co-operation of a number of analysts, among whom may be mentioned Meissl in Holland, and Wollny in Germany, and is now in such a condition that by attention to the prescribed details, which are capable of being precisely stated, the method is capable of affording accurate and strictly comparable results. What is known therefore as the Reichert-Wollny method of determining the amount of the volatile acids which butter may contain, fulfils in the opinion of the Committee the conditions of a quantitative method which is to be made the basis of judicial proceedings. This method consists in taking a definite amount of the butter-fat, converting it into a soap by the action of alkali, liberating the acids of the soap by treatment with dilute oil of vitriol, and then heating the acid solution in an apparatus of prescribed form and dimensions in such a manner that a definite and uniform volume of the liquid is distilled over in a definite and uniform time. The liquid so distilled contains about nine-tenths of the volatile acids obtainable from the butter, and their amount is determined by finding the quantity of alkali which is required to exactly neutralise them. The exact details of this method, as adopted by a committee consisting of the Principal of the Government Laboratory and members of the Society of Public Analysts, to determine the amount of butter-fat in margarine, are contained in a schedule attached to this Report. We suggest that the process thus described should be adopted in connection with the Regulation which we recommend should be framed in terms of Section 4 of the Sale of Food and Drugs Act, 1899.

Tichborne, 2416.
Richmond, 8957, 8963–5, 8944–6.
Allen, 9278–9. 9283.
Williams, 9400. 9413.
Jones, 9575–8.
Riple, 9729.
Lewin, 10736–7.
Vieth, 10971.
Stock, 11019–25.
Colwell, 11253–5.
Cassal, 11339.
Estcourt, 11640.

Schedule to Report, p. 27.

33. With respect to the limit to be set up by Regulation under this section, the Committee are of opinion that if the amount of the volatile acids in any sample of butter, as determined by the Reichert-Wollny method, should fall below the number 24, a presumption should be raised that the butter is not genuine.

34. In arriving at this decision the Committee had before them the evidence of analytical experts and the tabulated results of some thousands of determinations, more particularly of the volatile acids contained in butters of very variable origin.

Appendices, XXI.–XXXII.

35. The analytical numbers furnished to the Committee show that more than nine-tenths of the samples have a Reichert-Wollny number comprised

Appendices, XXI.–XXXII.

between the limits of 24 and 32, and that by far the greater amount of these are comprised between the limits of 26 and 31. Samples have been met with as high as 35 and as low as 18·4, but they are relatively very infrequent and are produced under exceptional and for the most part abnormal or remediable conditions. Many of the exceptional instances brought to the knowledge of the Committee were the produce of single cows or of very small herds. As the greater mass of commercial butter—that is, the butter which comes within the purview of the Sale of Food and Drugs Acts—is the product of large herds, or the mixed products of different dairies, abnormalities due to idiosyncrasy or to exceptional causes tend to disappear. Indeed as the factory and creamery systems of manufacture extend, and as modern methods of dairy management become more and more prevalent, it is obvious, as in the case of Denmark, that butter must become more and more uniform in its composition, and the Reichert-Wollny numbers therefore must tend to aggregate round the average, and the range of variation become less and less.

van Rijn, 9243-59.
Allen, 9303–11.
Lewin, 10640, 10657.

Appendix XXI.
Gissel, 3557.
Richmond, 9026-38.
van Rijn, 9237
Allen, 9371-3.
Jones, 9697-717.
Riple, 9745-50, 9864–5.
Lewin, 10662-8.
Stock, 11103–11.
Estcourt, 11765-66.
Muntz, 12571-3, 12612.

36. The Committee assume therefore that a Reichert-Wollny number of 24 will not act prejudicially upon any appreciable quantity of butter made in the United Kingdom. Colonial, American, Argentine, Danish, Swedish, French, and Italian butter will also be practically untouched by the limit. It may, however, occasionally affect Norwegian, Frisian, and Siberian butter. The ample information furnished by the representatives of Holland and of Russia, supplemented by the evidence which they were able to obtain from independent sources, enables the Committee to form a fairly accurate estimate of the extent to which the butter imported into the United Kingdom from these countries would be affected.

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van der Zande, 9170-4.
van Rijn 9226-9, 9237.
Appendix XXII. (A).
Bisschop, 11804.

37. As regards Holland, it would appear from the numbers furnished by Dr. van Rijn, that taking the whole year, 8 samples out of 633, or 1·2 per cent. of the butter produced in Friesland, which constitutes about eight-tenths of that exported from Holland to this country, may be expected to show a Reichert-Wollny number below 24. The remaining two-tenths is not subject to the same influences which tend to produce a minimal limit in the proportion of volatile acids. Hence it might be expected that about one per cent. of the annual importations of Dutch butter would be affected by the limit suggested. But as already stated, practically the whole of this abnormal butter is produced during about six weeks or two months of the year, varying with the nature of the season, that is, from the middle of September to the end of November. Thus the eight samples above-mentioned all occurred in a total of 94 butters which were received during October and November; and calculated upon the butter produced during this period it would appear that this abnormal butter amounts to about seven per cent.

van der Zande, 9085.

38. Since the time when Dr. van Rijn first drew attention to the influence of late pasturage on the character of Frisian butter, the Institute of Control of the Friesland Board of Agriculture has published a large number of analyses of Dutch butter made in the factories under the Institute. These analyses serve to show that now that the causes of the abnormality have been pointed out the Frisian farmers are seeking to obviate them. It may be expected that by the introduction to a still greater extent of the measures which have been proved to be efficacious in Denmark a still greater improvement will be effected. It may be hoped that the imposition of a limit such as is contemplated by the Committee, in the case of Holland's best customer, will have the result of accelerating these reforms.

Kalantar, 12106, 12127–8.

Appendix XXXII, Tables I. to IX.

39. In the case of Russian and Siberian butter, Mr. Kalantar expressed the opinion that a Reichert-Wollny number of 24 "would affect about 30 per cent. of the average winter butter, and about 15 to 20 per cent. of the butter produced all the year round." Judging, however, from the tables of analyses which Mr. Kalantar submitted, and upon which he was examined, there seems good reason to believe that his estimate is partly based upon unreliable data. In Table I (A) particulars are furnished of 146 samples of butter, the Reichert-Wollny number being given in 110 cases. Out of these 110, a Reichert-Wollny number below 24 was shown by 38 samples,

or about 34 per cent. In the case of 15 of these 38 abnormal samples the figure for the volatile acids was only slightly under 24, ranging from 23·6 to 23·9. It should be pointed out that Table I. (A) affords evidence that the samples had either been stored for a long time before being examined, or else had not been kept under suitable conditions. Thus 20 out of 166 samples were rejected as being mouldy, and were not analysed. Among those that were analysed, samples showing excessive amounts of acidity (rancidity) occur very frequently: thus about a dozen of the butters contained 10 per cent. or more of free acid—one showed even as much as 33 per cent.—and 68 out of 166, or nearly one-half of the whole number analysed (20 not being examined as they were mouldy), showed over 5 per cent. of acidity. Judging from these high amounts of acid, it seems probable that although samples which were obviously mouldy were rejected, yet the remaining butters when examined were in a more or less advanced state of decomposition.

40. The suspicion that many of the samples were not in a fit state for examination is strengthened when we compare the results given in Table I. (A) with those obtained in Table I. (B), and also with the figures yielded by the analysis of Russian and Siberian butter in the Government Laboratory of this country. The figures supplied by Mr. Kalantar in Table I. (B) are those of 75 samples of butter which were examined in the St. Petersburg City Laboratory. These analyses are much fuller than those of Table I. (A): they deal with winter butters; and though they are not entirely comparable with the latter inasmuch as they deal with different months, there is evidence that the samples when examined were in a better condition for analysis, and that they therefore represent more exactly the normal composition of Russian and Siberian butter. Indeed, in the "A" series of analyses the Reichert-Wollny numbers were at first not determined at all, and Mr. Kalantar admitted that the Bacteriological Laboratory of the Ministry of Agriculture, where the "A" analyses were made, was "too small for the work," and that there were "not enough analysts on the staff." Under such circumstances it is quite conceivable that the samples of butter should have had to be stored for comparatively long periods, with the effect already described.

Appendix XXXII.
Appendix XXXI.
Kalantar, 12371–93.
Kalantar, 12368.

41. In the "B" series of analyses only 5 samples out of 75 had more than 5 per cent. of free acid, showing that, as a rule, the butters were in a much fresher condition than those of the "A" series when the analyses were made. Out of these 75 samples, 3 had a Reichert-Wollny number lower than 24—that is, 4 per cent. of the whole number. A supplementary table subsequently forwarded by Mr. Kalantar includes, in addition to the analyses of the "A" and "B" series just mentioned, particulars of 168 further samples. Of these, 6 have a Reichert-Wollny figure lower than 24, and 4 of the 6 fall between 23·7 and 23·9 inclusive. This further series of samples, therefore, is of the same general character as the "B" series, the number 6 representing 3½ per cent. of the additional samples.

Appendix XXXII, p. 598.
Appendix XXXII, p. 604.

42. That this percentage, rather than the one deduced from the "A" series of samples, more nearly represents the normal composition of Russian and Siberian butter, may also be deduced from the figures obtained in the analysis of such butters at the Government Laboratory during the period April 1st, 1900—Jan. 15th, 1903. In this period there were examined 388 samples of the butter in question, including both Russian and Siberian. Of these 368 were taken by the Customs officers at the port of entry, and 20 were supplied by butter merchants. Three hundred and fifty-four of the butters were passed without question on the indications of the refractometer, specific gravity, &c., and the Reichert-Wollny number was determined in the remaining 34 cases. In 7 of the samples so tested—*i.e.*, in about 2 per cent. of the whole—the Reichert-Wollny number fell below 24.

Appendix XXXI.

43. As regards Norway, it appears from analytical results supplied by Mr. Riple, that the lowest Reichert-Wollny numbers are to be found in butter produced during the months from May to October. The weather during

Riple, 9730.
Appendix XXV.

Appendix XXV.
Riple, 9827–8, (*footnote.*)
Riple, 9742–3, 9860–5.

this time is somewhat changeable, and sudden changes in the composition of the butter-fat are found to result from turning the cows out to pasture in the early spring when the snows are not fully melted, or during a spell of cold and wet weather. The general result was exhibited in curves handed in by Mr. Riple, from which it was seen that from January to the middle of April the volatile acids lie between 30·6 and 33·1, then there is a gradual fall until the beginning or middle of June, when the Reichert-Wollny number is from 21·1 to 22·9, as a consequence of the cows being turned out into the pastures. During the remaining part of June and July there is, with a few and very small variations, an increase reaching in the first weeks of August to from 29·4 to 30·1. From then and during the month of September there is again a slight fall bringing the Reichert-Wollny figures down to 25·6, whereupon a marked and almost uninterrupted rise is noticeable for the remaining months of the year, in which the figure again reaches about 32·5 to 34·5 as a consequence of the cows being stabled. Mr. Riple stated that out of 657 samples analysed, 29, or 4·4 per cent., were found to be below the Reichert-Wollny figure of 25. The number below 24 would presumably be still smaller. As regards the influence of the period of lactation, from 50 to 75 per cent. of the cows calve during February, March and April. At the present time the amount of Norwegian butter imported into Great Britain is about 26,000 cwts. per annum, practically the whole quantity exported, and the greater portion arrives here during January, February, March and April—that is, during the months when it contains the highest proportion of volatile acids. During the summer, that is in June, July and August, when the volatile acids are at their lowest, the amount imported into this country is very small, the greater portion made being consumed at home.

Poole-Wilson, 1904–54.
Tichborne, 2406–18.
Gissel, 3556–7.
Richmond, 9041–3, 9019.
Allen, 9283, 9290, 9358.
Williams, 9397.
Jones, 9560, 9619.
Hehner, 10198–10200, 10162.
Dyer, 10228–31.
Lewin, 10658–9, 10681.
Stock, 11023, 11112.
Colwell, 11246–50, 11278.
Cassal, 11333–4, 11383.
Lloyd, 11587–92.
Estcourt, 11614–5, 11618–9.
Murtz, 12570.
Richmond, 8887–96.
Allen, 9273–7, 9291–3, 9326–7, 9342–3.

44. There was a considerable difference of opinion among the analysts both as to the practicability and the abstract desirability of fixing limits such as are contemplated by Section 4 of the Food and Drugs Act, 1899. Some of those who are mainly concerned in the working of the Food and Drugs Acts strongly impressed upon the Committee the necessity of fixing limits, and saw little or no practical difficulty in making use of one or more of the analytical criteria at present in use; other public analysts conceded the desirability but doubted the practicability, although they admitted that in their practice they made use of methods which implicitly, at all events as regards the inferences they draw from them, involved the adoption of limits. Mr. Hehner deprecated raising a presumption as to foreign fat by any method which did not directly determine the amount of added fat. In his opinion it was wrong to draw an inference as to the quantity of extraneous matter present from a deficiency in the amount of the normal constituents, apparently unmindful of the fact that this is precisely what is done in the case of milk, where a deficiency in the amount of fat or of the non-fatty-solids is held to warrant a presumption that the whole milk has been mixed either with separated milk or with water. No doubt the direct determination of the added water, or added separated milk, in whole milk would be desirable if it were practicable, and it would be equally desirable to have a method of directly determining the amount of margarine or other form of foreign fat added to butter, but Mr. Hehner was not in a position to give the Committee any such method, nor were other analysts more helpful in that respect. Attention was called to the fact that stearic acid is present to a very limited extent only in butter, whereas it makes up about one-sixth of the weight of margarine, and it was suggested that a method based upon that difference might be worked out, whereby the presence and the amount of margarine might be inferred. Mr. Allen was of opinion, however, that such a method would not be of much benefit, since oleo-margarine might be and indeed was made, containing very little stearin: it mainly consisted of palmitin and olein, both of which are essential constituents of butter and present in relatively large quantity.

Allen, 9275, 9291–3.
Faber, 9906–15.
Hehner, 10162.
Lewin, 10674–8.

45. Although the question was repeatedly put to analysts, there was no evidence tendered that any method of directly determining added margarine in butter was likely to be forthcoming in the near future, nor was any indication given as to the direction in which such a method was to be sought.

46. The Committee are, however, strongly impressed with the necessity of taking such steps as would directly identify margarine if present in butter, and they are the more convinced of the advisability of this in view of the opinion expressed by several witnesses that one effect of a prescribed limit might be, as is alleged to be the effect in Belgium, to induce and facilitate adulteration. In fixing any limit the Committee had to be mindful of two considerations: it must be sufficiently low not to press harshly upon too large a proportion of genuine if abnormal butters; on the other hand it must be sufficiently high to take away the inducement to admix margarine with butter having a high content of volatile acids to a point at which they would pass the limits laid down in the Regulation. The problem in this respect is somewhat similar to that with which the Board of Agriculture had to deal in the case of milk. The limits in that case were fixed, not to include the case of every sample of milk, but at a point which should prevent gross adulteration either with separated milk or with water. It must be admitted that a Reichert-Wollny limit of 24 would under certain circumstances admit of the addition of a certain quantity of foreign fat to butter, in amount dependent upon the richness of the butter in volatile acids, and upon the amount of butter which the law permitted to be added to margarine. Fraud of this kind might be checked if margarine were required to contain, as is the case in Germany, Austria, Belgium, and as is contemplated in France, some "tell-tale" or indicative substance, sufficiently sensitive to allow even small quantities of the margarine to be detected.

Richmond, 9009.
van der Zande, 9220–4.
Allen, 9321.
Jones, 9579.
Stock, 11059, 11150.
Appendix XXXIV.
Appendix XXXIV–V.

47. The Committee are strongly convinced of the desirability of extending the system of "ear-marking" margarine, which has been found to be effective in the countries named, by requiring manufacturers to use, as one of the vegetable oils to be employed in the production, 10 per cent. of sesamé oil.

Appendix XXXIV–V.

48. A number of the representatives of foreign countries who appeared before the Committee and who deprecated the imposition of any analytical limits upon their produce, considered that the only rational method of protecting this country against the importation of adulterated butter consisted in an effective system of control over the manufacture of butter and margarine on the part of the exporting country. The Dutch witnesses were particularly insistent upon this point. But neither Dr. van der Zande nor Dr. van Rijn, the accredited representatives of the Dutch Government, nor Dr. Bisschop, an advocate of the Dutch Bar, and Honorary Secretary of the Netherlands Chamber of Commerce in London, who volunteered in his private capacity to give evidence, could give the Committee any definite idea as to how this system of control would be effective, or how it would be possible to ascertain that a sample of Dutch butter exposed for retail sale in this country had been subjected to the control. The Dutch representatives admitted that the control meant not only supervision of the dairies and butter factories, but also chemical analysis. It was admitted that inspection by itself was not thoroughly satisfactory, but it was not made clear to the Committee what value was intended to be attached to the analytical facts when obtained, or to what use they would be put. Whilst, therefore, the Dutch representatives deprecated the fixing of analytical limits, they were unable to make any practical suggestion as to what should be done instead.

van der Zande, 9081–4, 9094, 9101.
Bisschop, 11881–928, 11950–9.
Bisschop, 11918–11928.

49. The idea of control, however, commends itself to the Committee, not in substitution for analysis, since the operation of the Food and Drugs Acts necessarily implies analysis—as a presumption could not otherwise be raised—but as tending to minimise the difficulties and danger admittedly attending the imposition of limits. In a large number of the countries producing butter for sale in this country a system of control more or less well organised exists already, and many of the witnesses who appeared before us were of opinion that by international co-operation and agreement it would be readily possible to make the system uniform and effective.

Sinclair, 6258–9.
Cameron, 6314–7.
van der Zande, 9084–9112.
Wray, 10400–1.
von Buchka, 10991.
Wedin, 11166, 11181–2.

50. We are of opinion therefore that steps should be taken to obtain international agreement on the subject, as suggested by the Dairy Congress organised by the National Dairy Society of Belgium, and held at Brussels on the 27th and 28th April, 1902—a Report of which, made by the Secretary of your Committee, who attended the meeting by direction of the Chairman, is appended. Appendix XXXIV.

51. To sum up our conclusions on that portion of our reference which was not dealt with in our Interim Report, we recommend :—

(1.) That the figure 24 arrived at by the Reichert-Wollny method should be the limit below which a presumption should be raised that butter is not genuine.

(2.) That the use of 10 per cent. of sesamé oil in the manufacture of margarine be made compulsory.

(3.) That steps should be taken to obtain international co-operation.

52. The Committee desire to record their high appreciation of the manner in which their Secretary, Mr. A. E. Balleine, has discharged the very onerous and often difficult duties which have been imposed upon him during the course of a prolonged inquiry.

We have the honour to be,
Sirs,
Your obedient servants,

HORACE PLUNKETT.
R. A. ANDERSON.
CHARLES A. CAMERON.
* P. G. CRAIGIE.
* CHRISTOPHER J. DUNN.
GEORGE GIBBONS.
* JOHN GILCHRIST.
HUDSON E. KEARLEY.
JOHN M. THOMSON.
T. E. THORPE.

A. E. Balleine,
Secretary,
1st December, 1903.

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* Subject to the Notes of Reservation appended.

NOTE BY MAJOR CRAIGIE, C.B.

I HAVE signed the Report of the Committee with some reluctance, and with the reservations set out in this Note.

So far as regards the advantages promised by the system of "earmarking" margarine and by more direct international co-operation and control in checking the adulteration of butter, I am anxious that the Recommendations Nos. 2 and 3 of the Committee may receive early acceptance.

I agree also that, as regards the question more directly referred to us, it is desirable to lay before the authorities responsible for the administration of the Sale of Food and Drugs Act the data bearing on the composition of butter which have now been brought together by the Committee, and the general conclusion we have reached, under the guidance of the eminent chemical advisers, whose services were by the constitution of the Committee available in our deliberations. That conclusion regards a deficiency in the normal proportion of the volatile fatty acids, which are the characteristic constituents of butter fat, as the best available test of adulteration, and it recommends the use of the Reichert-Wollny method of analysis for their determination. Should it hereafter become necessary to prescribe the particular proportion of these acids which should raise a legal presumption that the butter is not genuine by reason of the addition of foreign fat, I am disposed to concur in the Recommendation (No. 1) that the figure of 24 arrived at by the analytical method referred to is open to less objection than either a higher or a lower number.

I regret that I am, nevertheless, unable to regard the moment opportune or the information even yet sufficient to warrant the immediate issue of official Regulations in this matter under Section 4 of the Sale of Food and Drugs Act, 1899, as suggested in the text of the Committee's Report.

Paragraph 33.

Desirable as it may be thus to secure greater facilities for obtaining convictions in cases of adulteration with small percentages of foreign fat, which now escape punishment, I do not recognise, in the evidence laid before us, any sufficient proof that the advantages of a readier suppression of this particular class of fraud can be said to sufficiently outweigh the contingent risks of an unjust application of the presumption to butters where the proportion of distinctive acids is low, not by reason of any adulteration of the article, but from one or other of the numerous natural causes, referred to in the earlier paragraphs of the Report, as capable of presenting the same analytical results as actual adulteration with foreign fat. The practical difficulty to be encountered in rebutting the presumption of adulteration in the case of such a commodity as butter must, I submit, add weight to this consideration.

Paragraph 10.

Paragraphs 11–15.

My colleagues have so far recognised the deficiencies of the direct evidence available from other than foreign sources, as to press for a renewal, on a more exhaustive scale, of the special inquiry into the relative influence of the numerous factors, other than the addition of foreign fat, which affect the normal proportions of volatile acids in genuine butter made within the United Kingdom. I desire to urge the wisdom of obtaining the results of this new inquiry before imposing a statutory limit which would raise, irrespective of the origin or history of a particular sample, a legal presumption that the article is not genuine.

Paragraphs 23, 24.

A study of the details appearing on the diagrams, which have been circulated to the Committee since their final meeting, suggests, even more strongly than the general results communicated at an earlier stage, the need of further research. The particular limit recommended may be not unfairly applicable to the bulk of what the Report has described as "commercial" butters, and might but rarely jeopardise the reputation of genuine butters coming from considerable herds or from organised commercial factories at home or imported in bulk from abroad. It must, however, be recognised that butter manufactured from the produce of small groups of cows must still form a not inconsiderable portion of the butters of British origin, and it is in these that the particulars laid before the Committee reveal wide natural variations in the proportion of volatile acids which might bring such produce under unjustifiable suspicion.

Jones, 9,716.
Estcourt, 11,765.
Appendix XXI.
Appendix XXIX.
Lewin, 10,587, 10,714.
Brooke-Hunt, 11,965, 11,987 93, 12,040–4, 12,055.

The majority of my colleagues rely upon the evidence of the two public analysts for Stafford and Manchester, supplemented by the results of certain samples referred to by the chemist of the Aylesbury Dairy Company, as establishing the rarity of cases in which English butters would, as a matter of fact, be challenged under the standard recommended. I am unable to accept these statements, without further direct investigation, as a sufficient set off to the hesitation prompted by the relative frequency of ascertained instances of low proportions of volatile acids in genuine butters from the English dairies selected in 1901 for exact observation of the influence of breed, climate and treatment on the composition of the butter. Repeated instances of very low figures are recorded at places where no suspicion of bad management can be entertained, and under conditions which must arise elsewhere in ordinary farm practice. Nor can I find in the evidence tendered to the Committee such an explanation of these occurrences as would warrant their being disregarded without closer and more prolonged inquiry.

The evidence laid before us scarcely, I think, justifies the views expressed in paragraph 25 of the Report, that butter made in this country forms only a relatively small proportion of that which may ordinarily come under the operation of the Sale of Food and Drugs Acts. Although we have no exact figure establishing the ratio of the domestic to the foreign supply of butter, no material dissent was forthcoming to the estimate, formerly current, that the native supply might still reach 100,000 tons or one-half of the 200,000 tons of imported produce consumed in 1902 and set out in detail in the tables of Appendix XXXIII. Even allowing for the portion consumed without being the subject of a sale, the home produced butter may still represent a larger bulk than the 85,000 tons credited to Denmark, and in the aggregate it is probably quite four times as great as the supply sent either by Russia or by Holland.

These considerations suggest that official action should await and not precede the supply of particulars of the varying conditions governing the composition of the home produce as full as those collected respecting the butters of the great exporting states.

Hehner, 10,155.
Dyer, 10,234, 10,242.

My inability to adhere to any proposal to proceed, without further inquiry, to the issue of a Regulation under Section 4 of the Act of 1899 is strengthened by regarding the somewhat formidable volume of testimony offered in deprecation of such action at the present time. Apart from the Foreign representations to which we have given careful attention, and which have been dealt with in detail in the text of the Report, the minutes of evidence disclose not only a wide division of expert opinion at home, but also a reluctance on the part of witnesses nominated by important public bodies to accept early action in the direction suggested, which has scarcely, in my judgment, been conclusively met by the references made in paragraph 44.

Richmond, 9012–8.
Allen, 9279.
Hehner, 10,156.

Besides demurring on these grounds to the timeliness of proceeding forthwith by Regulation, as in the less difficult case of milk adulteration, I find it difficult in this connection to overlook the tendency which was brought to the notice of the Committee during their deliberations, to apply any statutory limit to a purpose different from that contemplated by the Act of 1899, and to regard it as setting up a general standard of quality to which producers should be made to conform, even under conditions involving on their part material outlay and change of practice. Any such extension of the legal presumption in the case of an article of such varied character and price as butter, would, it seems to me, have less justification than in the case of milk where the analytical variations proposed to be relied upon appear to bear a closer relation to the real and nutritive value of the commodity.

P. G. CRAIGIE.

NOTE BY MR. DUNN.

I agree with the Report which I have signed, except that I am of opinion that the figure 23 arrived at by the Reichert-Wollny method would be a safer limit than the one mentioned in the Recommendation [Paragraph 51 (1)].

CHRISTOPHER J. DUNN.

NOTE BY MR. GILCHRIST.

I have carefully considered the evidence, and, whilst I have signed the Report, I desire to state my reasons for making the following reservations. I am in complete agreement with the majority of the Committee regarding all the conclusions arrived at, with the exception of paragraphs Nos. 25, 33, 36 and 51 (1). It has been generally understood that butter from exposed districts such as Caithness, Orkney, and the Shetland Isles had a low percentage of the volatile acids, and it was not thought that much butter from the lower and more sheltered inland districts would contain such a low percentage of these acids. The results of the analysis of the samples of butter sent in from England, Scotland, and Ireland to the Government Laboratory have not justified these opinions. The Committee had a number of samples of butter from England, Scotland, and Ireland which were under the limit now recommended by the majority of the Committee, and in three cases this occurred for four months during the producing season.

I desire, therefore, to point out the urgent necessity for further enquiry being made before the limit of 24 Reichert-Wollny be made the legal standard. While agreeing with the majority of the witnesses that adulteration must be firmly put down, I am afraid that the Reichert-Wollny No. 24, recommended by the majority of this Committee, would unduly harass some honest producers in this country, as well as in other countries, and the onus and burden of proving innocence, so far as adulteration has taken place, must be very troublesome and very expensive to innocent people. In the case of milk, a ready appeal could be made to the cow or cows, at the fountain-head of supply, but with regard to the butter, this appeal is neither so easy or so reliable.

Some professional witnesses have stated that the farmer has it in his power to so arrange the management of his dairy, as regards shelter, lactation period, and feeding, that his cows will give butter with a higher Reichert-Wollny number. I would, however, point out that so little is known regarding this subject, that it is unfair to expect a farmer to deal with a subject which at present is not fully understood. In practice it is impossible to provide for the variations of temperature, the calving of the herds over the year, and the effects of different foods.

I was much impressed with the evidence given by the French chemist, Professor Müntz, who stated that French butter contains a relatively larger proportion of the volatile acids than most butters, and at another place he informed us that the limit adopted by him in the Government Laboratory was equal to $22\frac{1}{2}$ Reichert-Wollny. He also said this limit was too high for the Dutch and Friesland butters. As we are importing our butter from many countries any standard which is higher than that adopted by Professor Müntz would, in my opinion, be too high, would lead to serious difficulties and would seriously cripple and hamper the butter industry. Müntz, 12528, 12535, 12539–40.

At present each individual chemist in his district fixes a limit of his own, and on that limit, with the official head of the Government Laboratory acting as referee, the defendant is presumed to be guilty till he proves his own innocence. Keeping in view how little is known regarding the causes of low percentages of volatile acids in butter, I am of the opinion that the Committee should fix a low limit, so as not to disturb the present methods for detecting adulteration. I believe my opinion is supported by the majority of the professional witnesses.

I therefore support the limit of 23 Reichert-Wollny, and am encouraged to do this by the statements made by many of the professional witnesses, wherein they said that no prosecution would in all likelihood be raised if the butter came to within one degree of the limit fixed by the Board of Agriculture.

I agree most thoroughly with the recommendation No. 2 that the use of 10 per cent. of sesame oil in the manufacture of margarine be made compulsory, and would respectfully point out that if this recommendation is put into force the need for a high limit based on the Reichert-Wollny number becomes much less urgent.

JOHN GILCHRIST.

REPORT BY MR. HICKEY.

To the **President** of the **Board of Agriculture and Fisheries**, and the **Vice-President** of the **Department of Agriculture and Technical Instruction for Ireland.**

Sirs,

(1.) Having carefully considered the evidence presented to the Committee on the testing of the purity of butter with respect to the proportion of volatile acids, I have been reluctantly forced to the conclusion that it does not afford solid grounds for the fixing of any limit based upon such proportion. I beg, therefore, to submit my conclusions in a separate report.

(2.) Of the thirty-three witnesses who appeared, two gave no opinion on this subject; and eight made no definite recommendation; ten (all of whom were chemists) were in favour of an official limit varying from 22 to 25 (Reichert-Wollny), and thirteen (eleven of whom were chemists) were against the establishment of a limit of any kind. Four of the latter, who were opposed to an official limit, nevertheless set forth their views as to its character and application, if it should be determined to adopt one.

(3.) The following is a list of the witnesses who recommended the establishment of a limit:—Mr. Cassal, Public Analyst, Kensington; Mr. Colwell, Public Analyst for the Borough of Holborn; Mr. Estcourt, Public Analyst, Manchester; Dr. Gissel, Analyst to the Maypole Dairy Company; Mr. Lewin, Superintending Analyst, Government Laboratory; Professor Müntz, Chemist and Representative of the French Government; Mr. Droop Richmond, Analyst to the Aylesbury Dairy Company; Mr. W. F. Keating-Stock, Public Analyst for the County of Durham, etc.; Professor Charles R. C. Tichborne, Public Analyst, and District Analyst under the Local Government Board, Ireland; Dr. Veith, Principal of the Hameln Dairy Institute, Consulting Chemist for the Province of Hanover, and formerly Analyst to the Aylesbury Dairy Company.

(4.) The following is a list of the witnesses who were opposed to the establishment of a limit:—Mr. A. H. Allen, Public Analyst for the West Riding of Yorkshire, and for the City of Sheffield; Dr. W. R. Bisschop, Honorary Secretary of the Netherlands Chamber of Commerce, London; Dr. Bernard Dyer, Public Analyst for several Counties, Delegate of the Institute of Chemistry, and of the Society of Public Analysts; Mr. Harald Faber, Chemist, and Dairy Representative of the Danish Government in England; Dr. Otto Hehner, Public Analyst, Delegate of the Institute of Chemistry and of the Society of Public Analysts; Mr. Brooke-Hunt, Superintending Inspector of the Board of Agriculture; Mr. E. W. T. Jones, Public Analyst for the County of Stafford, and the Borough of Wolverhampton, etc.: Mr. Kalantar, Chemist, Agricultural Expert, and Delegate of the Russian Government; Mr. F. J. Lloyd, Analyst, Representative of the Bath and Western and Southern Counties' Society, and of the British Dairy Farmers' Association; Professor Van Rijn, Chemist and Director of the Agricultural Experiment Station at Maastricht, and Representative of the Department of Agriculture, Holland; Mr. Collingwood Williams, Public Analyst, Liverpool, etc.; Mr. A. Poole-Wilson, Analyst, late Technical Expert for the Maypole Dairy Company, and Dairy Instructor under the Board of Agriculture and Technical Instruction for Ireland; Dr. Van der Zande, Chemist, Director of the Agricultural Experiment Station, Hoorne, and Representative of the Department of Agriculture, Holland.

(5.) So far, therefore, as numbers are concerned, the weight of evidence is decidedly against the setting up of an official limit. And if the authority and qualifications of the witnesses are taken into account, the preponderance of numbers is rather strengthened than weakened, although it cannot be doubted that some of those who favoured the fixing of a limit are also of the highest rank in their profession.

Van der Zande, 9055.
Hehner, 10,153.
Colwell, 11,252.
Lloyd, 11,455.
Kalantar, 12,104.
Allen, 9315.
Dyer, 10,231.
Gissel, 3468–89.
Van der Zande, 9134–9.
Williams, 9485–6.
Riple, 9745–7.
Faber, 9962.
Müntz, 12,523.

(6.) The reasons given for the opposition to a fixed limit confirm the conclusion drawn from the number and relative weight of the witnesses. The main reason is, that it is impossible to infer with certainty that butter has been adulterated with small or moderate quantities of foreign fat whenever a low proportion of volatile acids is found. Such low proportion, it is proved, may be due not to adulteration, but to natural circumstances, the full operation of which has not yet been satisfactorily determined. These circumstances, as set forth in paragraph 11 of the Report, arise to a certain extent, "out of climatic conditions, period of lactation, nature and amount of food, breed, and idiosyncrasy of the cow."

Van der Zande, 9055.
Allen, 9279.
Williams, 9398.
Hehner, 10,121.
Stock, 11,005.
Lloyd, 11,437–8.
Müntz, 12517–19.
Allen, 9290.
Hehner, 10,153–5.
Dyer, 10,231
Kalantar, 12,104.
Richmond, 9012.
Van der Zande, 9115–20.
Allen, 9317–18.
Faber, 9903.
Hehner, 10,156.
Kalantar, 12,235.
Müntz, 12,560, 12,595, 12,610.
Lewin, 10,657, 10,688.

(7.) The chief reasons given by the witnesses against the fixing of a limit were: the natural variation in the composition of butter fat (which is now admitted to be much larger than was at one time supposed); the inadequacy of existing analytical methods; and the fact that the commercial value of butter does not depend on the proportion of volatile acids it may contain. A high limit would therefore punish the innocent man and would shut out pure butter in many cases, whilst a low one might lead to sophistication. Only one of the witnesses who referred to the commercial aspect of the question, took an opposite view. The commercial value is mainly dependent upon the flavour of the butter, and even this witness declared that this particular quality is largely due to the system of ripening the cream, and not to the content of volatile acids which, according to his evidence, may remain unaltered even when the butter has become absolutely bad. It is true that Mr. Lewin, the Government Analyst, offered the provisional suggestion that the physical discomfort of the cow, arising from improper feeding or unfavourable conditions, such as excessive heat or undue exposure to cold, would have a deteriorating effect upon the quality of the butter.

Gissel, 3468.
Richmond, 8992.
Vieth, 10,938.
Kalantar, 12,124.
Williams, 9476.
Hehner, 10,144.
Müntz, 12,600.
Richmond, 9008.
Van Rijn, 9247–8.
Veith, 10,927–8.
Faber, 9977, 9980.

(8.) There was considerable difference of opinion amongst many of the witnesses as to the causes of variation in the chemical composition of butter fat; but the majority held that the period of lactation was the chief factor in such variation. When the cows are getting dry and giving less milk, the amount of volatile acids progressively decreases. A considerable decline in the proportion of volatile acids occurs in the butter made in the late autumn and in the early part of winter. Some witnesses held that this difficulty would be overcome, if half the cows were caused to calve, for example, in the spring, and the remainder in the autumn, and if the cattle were stabled earlier and received more generous food. But evidence was adduced showing that where this was done, and when they calved all the year round, autumn-made butters showed lower figures, than those made at other times of the year. Dr. Veith (Principal of the Dairy Institute, Hameln, Germany), stated that the same thing occurs every year in Germany, viz., that in autumn figures are very low, even where the samples are taken from large dairies, working 4,000 gallons of milk daily, and from herds of cows always under cover. If farmers were compelled to arrange for the calving of their cows throughout the year, serious expenditure would be entailed, without improving the quality of their butter. In the case of Siberia, one of the witnesses stated that if the cows were calved there in the autumn, the calves would inevitably die, and the cows would also be in great danger of dying, on account of the inclement weather and lack of food, which could only be supplied at a cost which would not be remunerative.

Lewin, 10,568–76.

(9.) The indeterminate character of our present knowledge on this subject is abundantly demonstrated throughout the whole of the evidence presented to the Committee, but it is strongly apparent in the tests made under the direction of the Board of Agriculture in 1901, at forty places mostly farms, in different parts of the United Kingdom. These farms were chosen with a view to obtaining samples made under every condition that cows might be subjected to during the year, and the tests were arranged to cover all elements likely to determine the character of the butter. No doubt can be raised as to the purity of the butter in these cases, and yet the striking fact emerges that the produce of twenty-five per cent. of these establishments, some of which were County Council Farms and some Irish Co-operative Creameries, representing the produce of numerous herds, showed at times a Reichert-Wollny number considerably under 24, the variation being from 19·4 to 23·9. The vendors of this undoubtedly pure butter would have been liable to prosecution for selling an impure article, if the limit of 24 recommended by most of my colleagues, were established.

Lewin, 10,594–9
Lewin, 10,732.
Appendix xxx.

(10.) With reference to the suggestion in paragraph 38 of the Report that the quality of Dutch butter might be so raised as to avoid injustice to the producer in the imposition of the proposed limit, I may submit that in my opinion, sufficient attention has not been given to the information embodied in Dr. Van Rijn's book on "The Composition of Dutch Butter," copies of which were furnished to the Committee. The results of a series of 428 analyses carried out under the supervision of Professor H. P. Wysman of Leyden, Professor Van Rijn, and an official who was specially appointed to choose the samples from butter churned in his own presence, are set forth in detail in the work referred to. The dairies were selected so that they should differ as much as possible with regard to breed, age, feeding, stabling, and calving of the cows. The samples represented the produce of factories as well as farms, and all the butter was made in the last four months of 1901. Out of the 428 samples analysed as many as 140, or nearly one-third, fell under the Reichert-Wollny number of 24, the range of these being from 17·0 to 23·9.

"The Composition of Dutch Butter," p. 3. par. 2.
p. 13, paras. 2, 3, 4, 6.
p. 15.

(11.) I draw especial attention to the East and West Ridings County Council Farm, Garforth, near Leeds, which shows a variation from 19·4 to 23·6 (Reichert-Wollny) in the butter made there during the months of August, September, October, November, 1901, and February, 1902, and also to the results obtained at the Midland Dairy Institute, Kingston, Derby, showing that from July to November, 1901, inclusive, the butter produced there was continuously under the proposed limit.

Appendix xxx.

(12.) On the one hand, speaking of the butter made at these institutions, Mr. Lewin (Superintending Analyst of the Government Laboratory) thought that the cows had not been normally treated. He assigned the anomalous figures obtained from these dairy schools to some extraordinary experimental treatment on the part of the managers, and there appeared to him to be no other explanation why the butter at these establishments should give such figures. Further, he stated that 22·5 (Reichert-Wollny) in July was absolutely unique in the history of butter analysis, and that he never before found a butter in July coming from any farm whatever, with such a figure. He was also of opinion that Kingston farm (Midland Dairy Institute) was not properly conducted.

Lewin, 10,585–6.
Lewin, 10,712–15.

(13.) On the other hand, Mr. Brooke-Hunt (Superintending Inspector of the Board of Agriculture) declared that he found no special circumstances whatever, although he searched diligently, to account for the low Reichart-Wollny figures found at these farms. He also stated that the cattle were kept under perfectly natural conditions all through the summer, and that the system of butter manufacture at these institutes was precisely the same as at any other institute or well-conducted farm in the Kingdom. No experiments were being conducted on any of the cows, and he added, that the Midland Dairy Institute, Kingston, is an exceedingly well-managed one. Low Reichert-Wollny figures were also obtained there in 1902.

Brooke-Hunt, 12,029–32.
Brooke-Hunt, 11,988–93.
Brooke-Hunt, 11,974.
Brooke-Hunt, 11,982.
Brooke-Hunt, 12,019–24.

Poole-Wilson, 1914.
Allen, 9279.
Williams, 9411-12.
Jones, 9692-94.
Faber, 9898-9.

(14.) Paragraph 11 of the Report seems to me to be exceedingly important. It leaves no room for doubt that butter of absolute purity may be deficient in volatile acids, owing to one, or more, or all of the circumstances referred to. It is certain, therefore, that no limit based upon the present chemical tests, can be fixed, which might not lead to the condemnation of a considerable quantity of perfectly pure butter, and to the punishment of innocent persons. If the limit were made too high, a large quantity of genuine butter, both home and foreign, would be certified as adulterated. If it were made too low, the door would be opened to the fraudulent sale of impure butter.

Harrington, 4906.
Richmond, 9021.
Allen, 9291.
Williams, 9405.

(15.) It may be possible, after the uncertainty at present existing has been removed by research, and by the adoption of international action, to establish a limit, such as is indicated by the Committee. In my opinion, that stage has not yet been reached, and it would be highly dangerous to fix such a limit, especially in view of the decision given by the High Court in the milk case of *Smithies v. Bridge*, the particulars of which were brought under the notice of the Committee at its final meeting. In that instance the Court held that the sale of milk of a low quality, was, notwithstanding its genuineness, to the prejudice of the purchaser, and therefore an offence under Section 6 of the Food and Drugs Act, 1875.

(16.) For the reasons herein set forth, I regret that I am unable to sign the Report of the majority of the Departmental Committee.

I have the honour to be,

Sirs,

Your most obedient servant,

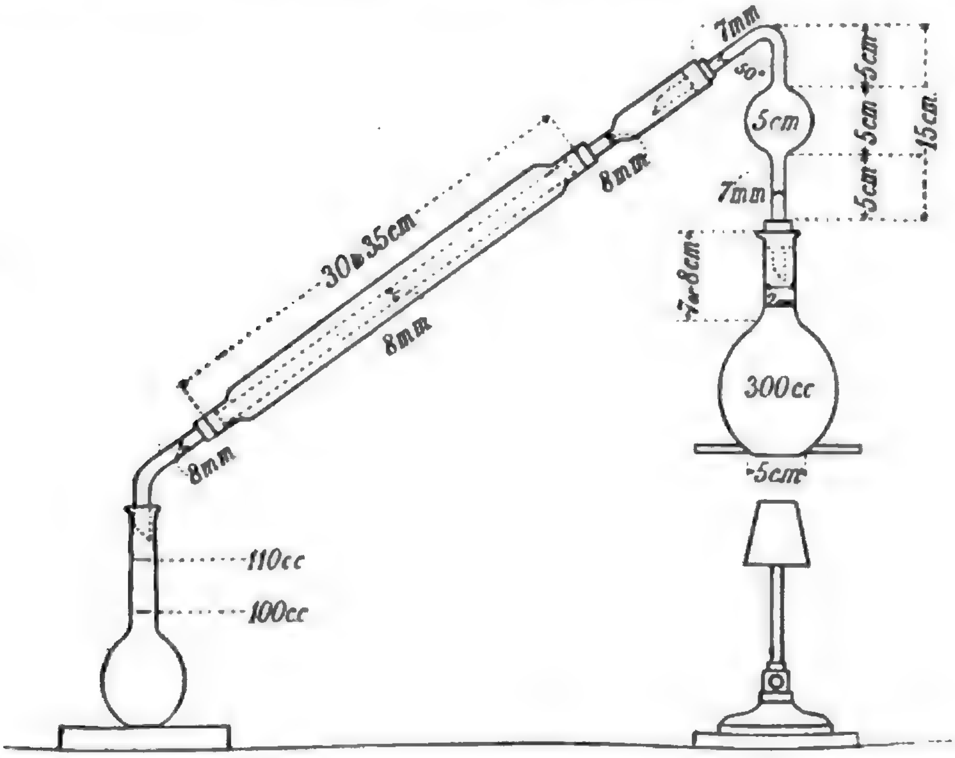
PATRICK HICKEY.

SCHEDULE TO THE FINAL REPORT OF THE BUTTER REGULATIONS COMMITTEE.

Extract from "The Analyst," December, 1900.

THE REICHERT-WOLLNY METHOD FOR DETERMINATION OF VOLATILE FATTY ACIDS IN MARGARINE AND BUTTER.

Five grammes of the liquid fat are introduced into a 300 c.c. flask, of the form seen in the figure (length of neck 7 to 8 centimetres, width of neck 2 centimetres). Two c.c. of a solution of caustic soda (98 per cent.) in an equal weight of water—preserved from the action of atmospheric carbonic acid—and 10 c.c. of alcohol (about 92 per cent.) are added, and the mixture is heated under a reflux condenser, connected with the flask by a T-piece, for fifteen minutes in a bath containing boiling water. The alcohol is distilled off by heating the flask on the water-bath for about half an hour, or until the soap is dry. One hundred c.c. of hot water which have been kept boiling for at least ten minutes are added, and the flask heated until the soap is dissolved. Forty c.c. of normal sulphuric acid and three or four fragments of pumice or broken pipe-stems are added, and the flask is at once connected with a condenser by means of a glass tube 7 millimetres wide and 15 centimetres from the top of the cork to the bend. At a distance of 5 centimetres above the cork is a bulb 5 centimetres in diameter. The flask is supported on a circular piece of asbestos 12 centimetres in diameter, having a hole in the centre 5 centimetres in diameter, and is first heated by a very small flame, to fuse the insoluble fatty acids, but the heat must not be sufficient to cause the liquid to boil. The heat is increased, and when fusion is complete 110 c.c. are distilled off into a graduated flask, the distillation lasting about thirty minutes (say from twenty-eight to thirty-two minutes), the distillate is shaken, 100 c.c. filtered off, transferred to a beaker, 0·5 c.c. of phenolphthalein solution (1 gramme in 100 c.c. alcohol) added, and the filtrate titrated with decinormal soda or baryta solution. Precisely the same procedure (with the same reagents), omitting the fat, should be followed, and the



amount of decinormal alkali required to neutralize the distillate ascertained. This should not exceed 0·3 c.c. The volume of decinormal solution of alkali used, less the figure obtained by blank experiment, is multiplied by 1·1. The number so obtained is the "Reichert-Wollny Number."

Notes on the Method.—The sample is melted and filtered from curd and water through a dry filter. From the filtrate the 5 grammes of fat for the process are taken. The soda solution is filtered clear from carbonate formed in its preparation, and kept in a special bottle. The Soxhlet spherical condenser is a convenient one for the reflux distillation. This is fixed near the water-bath in which the saponification is to take place, and is connected with the flask by means of a T-piece and indiarubber tubes inclined at an angle of 45°. During the saponification the free limb of the T-piece is directed upwards, and its end closed by a short piece of indiarubber and glass rod. At the end of fifteen minutes this limb is turned downward, and the piece of glass rod replaced by a tube carrying away the alcohol.

One hundred c.c. of hot distilled water are added, and the flask frequently shaken until the soap is dissolved. The Liebig is a convenient form of condenser. One containing a column of water 30 to 35 centimetres in length gives sufficient condensing surface. After shaking the distillate, about 5 c.c. are filtered through a dry paper into a 100 c.c. flask. This serves to wash out the flask. When the 100 c.c. are transferred to a beaker, the flask is not washed out, but the main quantity is neutralised with the standard solution of alkali and returned to the flask, then again transferred to the beaker and the titration completed.

COMMITTEE ON
BUTTER REGULATIONS.

FINAL REPORT.

COMMITTEE ON BUTTER REGULATIONS.

MINUTES OF EVIDENCE
TO THE
FINAL REPORT
OF THE
DEPARTMENTAL COMMITTEE
APPOINTED BY THE
BOARD OF AGRICULTURE
AND
The Department of Agriculture and other Industries and Technical Instruction
for Ireland,

TO INQUIRE AND REPORT UPON THE DESIRABILITY OF
REGULATIONS,
Under Section 4 *of the Sale of Food and Drugs Act,* 1899,
FOR
BUTTER,
WITH
A DIGEST OF THE EVIDENCE, APPENDICES, DIAGRAMS
AND AN
INDEX TO THE TWO VOLUMES.

Presented to both Houses of Parliament by Command of His Majesty.

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1904.

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CONTENTS.

LISTS OF WITNESSES - - - - - - - - Page xix, xx

DIGEST OF THE EVIDENCE - - - - - - - - " xxi

MINUTES Do. - - - - - - - - " 333

APPENDICES - - - - - - - - - - - " 479

INDEX - - - - - - - "

LIST OF WITNESSES.*

III.—IN CHRONOLOGICAL ORDER.

No.	Name.	Description.	Page Index.
*56	RICHMOND, F.I.C., Mr. H. D.	Analyst to the Aylesbury Dairy Company	xxi, 333
57	VAN DER ZANDE, Dr.	Representatives of the Netherlands Government	xxi., 340
58	VAN RIJN, Dr.		xxi., 345
59	ALLEN, F.I.C., Mr. A. H.	Public Analyst for the West Riding County Council	xxi., 346
60	COLLINGWOOD WILLIAMS, B.SC. (Lond.), Mr. W.	Analytical Chemist	xxii., 352
61	JONES, F.I.C., Mr. E. W. T.	Public Analyst for Staffordshire, etc.	xxii., 357
62	RIPLE, Mr. ALBERT	Agricultural Agent to the Norwegian Government in Great Britain.	xxii., 364
63	FABER, F.I.C., Mr. HARALD	Commissioner to the Danish Government	xxiii., 370
64	HEHNER, F.I.C., Mr. OTTO	Delegates of the Institute of Chemistry, and the Society of Public Analysts	xxiii, 378
65	DYER, D.SC. (Lond.), Dr. BERNARD		xxiii., 383
66	FENWICK, Mr. E. N. F.	Magistrate, Bow Street Police Court	xxiv., 386
67	WRAY, Dr. W. H.	Representative of the U.S.A. Government	xxiv., 391
68	VON BUCHKA, Dr., Professor	Representatives of the German Government	xxiv., 394
69	VIETH, Dr., Professor		xxiv., 413
70	LEWIN, F.I.C., Mr. G.	Superintending Analyst, Government Laboratory	xxv., 399
71	WATKINS, J.P., Mr. J. F.	Chairman of the Watford Bench	xxv., 408
72	STOCK, F.I.C., Mr. W. F. K.	Public Analyst for the County of Durham, etc.	xxv., 417
73	WEDIN, Mr. HUGO	Commissioner in Great Britain for Sweden	xxvi, 421
74	COLWELL, F.I.C., Mr. J. K.	Public Analyst for Borough of Holborn, etc.	xxvi, 426
75	CASSAL, F.I.C., Major C. E.	Public Analyst for Borough of Kensington, etc.	xxvi., 429
76	LLOYD, F.I.C., Mr. F. J.	Representative of the Bath and West and Southern Counties' Society, and of the British Dairy Farmers' Association.	xxvi,, 434
77	ESTCOURT, F.I.C., Mr. C.	Public Analyst for, and Representative of, the Manchester Corporation.	xxvii., 441
78	BISSCHOP, Dr. W. R.	Hon. Secretary of the Netherlands Chamber of Commerce in London.	xxvii., 447
79	BROOKE-HUNT, Mr. A. E.	Superintending Inspector to the Board of Agriculture.	xxvii., 453
80	KALANTAR, Mr.	Representative of the Russian Government	xxvii., 457, 463
81	MUNTZ, Professor A.	Representative of the French Government	xxviii., 472

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* Continued from the Interim Report.

LIST OF WITNESSES.

IV.—IN ALPHABETICAL ORDER.

An asterisk indicates Representatives of Foreign Governments.

No. on List III.	Names of Witnesses.	Page Index.	No. on List III.	Names of Witnesses.	Page Index.
59	Allen, Mr. A. H. -	xxi., 346	80	*Kalantar, Mr. - - -	xxvii., 457, 463
78	Bisschop, Dr. W. R. - -	xxvii., 447	70	Lewin, Mr. G. - - -	xxv., 399
79	Brooke-Hunt, Mr. A. E. -	xxvii., 453	76	Lloyd, Mr. F. J. - -	xxvi., 434
75	Cassal, Major C. E. - -	xxvi., 429	81	*Muntz, Professor A. -	xxviii., 472
60	Collingwood Williams, Mr. W.	xxii., 352	56	Richmond, Mr. H. D. -	xxi., 333
74	Colwell, Mr. J. K. -	xxvi., 426	62	*Riple, Mr. Albert - -	xxii., 364
65	Dyer, Dr. Bernard - -	xxiii., 383	72	Stock, Mr. W. F. K. -	xxv., 417
77	Estcourt, Mr. C. - -	xxvii., 441	57	*Van der Zande, Dr. -	xxi., 340
63	*Faber, Mr. Harald - -	xxiii., 370	58	*Van Rijn, Dr. - - -	xxi., 345
66	Fenwick, Mr. E. N. F. -	xxiv., 386	69	*Vieth, Dr. Professor - -	xxiv., 413
64	Hehner, Mr. Otto - -	xxiii., 378	68	*Von Buchka, Dr. Professor	xxiv., 394
61	Jones, Mr. E. W. T. -	xxii., 357	71	Watkins, Mr. J. F. - -	xxv., 408
			73	*Wedin, Mr. Hugo - -	xxvi., 424
			67	*Wray, Dr. W. H. - -	xxiv., 391

DIGEST OF THE EVIDENCE.*

Mr. H. DROOP RICHMOND, F.I.C. (56)

Analyst to the Aylesbury Dairy Co., 8866; other qualifications, 8865-8, 9025-6.

Recommends the Reichert-Wollny method, 8957, 8963-5; and the Reichert-Wollny figure of 25 cc., 9006; as a standard for butter fat. Although only a makeshift, 9019, 9042; a standard is necessary, 9041-3. One year's notice should be given in order that producers may arrange the period of lactation, and stable cows earlier, 9007-10, 9046-7. A 25 Reichert-Wollny might be a hardship in some cases, 9013; it would not seriously affect Siberian butter, 9010-11; a lower Reichert-Wollny figure would be detrimental, 9009.

There is no connection between the commercial value of butter and the Reichert-Wollny figure, 9012-8. The milk standard analogy, 9014; is not perfect, 9015-7.

The chemical nature of butter fat, the acids, and their characteristics, by which butter fat is distinguished from other animal fats, 8874-84. The "foreign" fats which are used to adulterate butter, 8885-92, 8900. Butter fat contains relatively large quantities of butyric acid, 8878, 8890; and not more than 2 per cent. of stearic acid, 8887-8; while animal fats which may be used to adulterate butter contain relatively large quantities of stearic acid (up to 50 per cent.), 8889-91, 8894-5; and practically no butyric acid, 8886, 8900. Vegetable oils are used to adulterate butter in a relatively small proportion, 8891-3, 8896-9, 8901-9. The chemical tests, 8910-5.

The methods by which the presence of adulterants in butter can be recognised, 8916-90:—

(1) Hehner's method; the determination of the insoluble fatty acids, 8917-41; has certain defects, 8919, 8943. Variations observed, 8920-31.

(2) The estimation of the soluble fatty acids in the filtrate from the insoluble fatty acids *without distillation*, 8941-2; is not perfect, 8942.

(3) The Reichert-Wollny method for the determination of the volatile acids, *by distillation*, 8944-65. The limits of variation, 8947-56. This method is the most accurate, 8945, 8958-60; and the most suitable, 8945, 9019.

(4) The Koettstorfer process, *i.e.*, the potash absorption, or saponification, method, 8966-76; has a certain drawback, 8966-7, 8976; but it is valuable in conjunction with the Hehner process, 8971-2. Limits of variation, 8973-5.

(5) The determination of the density is only a fairly satisfactory method, 8976-9.

(6) The estimation of the iodine absorption depends wholly on the quantity of oleic acid, 8980-1.

(7) The determination of the refractive index probably depends on the same property, 8982-9.

These factors are affected by various conditions, 8991-9004: The Reichert-Wollny figure by the period of lactation, cold weather, food, breed, 8992, 9008, 9034-9; and season of the year, 8994-9004, 9036. The effect of season on the iodine value, 8997-9004.

The Government should encourage research work into the composition of butter, and its variation, 9020-1, 9044-5; as in some foreign countries, 9022-4.

Statistics of samples below 25 Reichert-Wollny, 9026-40. French and Italian butters contain a higher Reichert-Wollny number than any other butter, 9038-9.

Digest of the Evidence.

REPRESENTATIVES OF THE NETHERLANDS GOVERNMENT:

(1) Dr. VAN DER ZANDE, (57)

Director of the Agricultural Experimental Station at Hoorn, 9048-52, 9156-61.

Officially opposes the fixing of a standard for fats, 9053-5, 9072-83, 9122. The Netherlands Government would strongly object to a 25 Reichert-Wollny limit, 9113-6; because it would declare as adulterated much Dutch butter which is genuine, 9056-60, 9170-1; especially butter from meadow lands during the late autumn, 9057, 9172-6, 9203-10; where, as in Friesland, the system of farming cannot altogether be changed, 9071-4, 9177-8.

Instead of chemical means of protection against fraud, he personally advocates the control of butter-making, 9081-4, 9094-9101, 9123. The Institute of Control of the Friesland Board of Agriculture, 9084-93, 9102-12; its rules, 9085. The adulteration of Dutch butter, 9184-96; and the means of prevention by the control system, 9197-200; and Government measures, 9201-2, 9216-19. The Belgian standard of 25 Reichert-Wollny, 9058; has tended to adulteraton, 9220-14.

Butter with a low Reichert-Wollny number may be commercially more valuable than with a high number, 9116-22. 650 Reichert-Wollny determinations of Friesland butter, 9162-83, 9251-2; of which 3 per cent. are below 25 Reichert-Wollny, 9170.

Dr. van der Zande does not agree with Dr. Van Rijn, 9226; that the abnormal chemical composition of Dutch butter is wholly due to leaving cattle in the meadows until late in the year, 9071, 9124-30. There are other circumstances, *e.g.*, lactation, 9135-6, 9148-55; feeding, 9137; the individuality of the cow, 9138-44; and other influences which have not been traced, 9131-4, 9142-55, 9210-15.

(2) Dr. VAN RIJN. (58)

Director of the Agricultural Experimental Station at Maastricht, 9048-52.

It is firmly established that where cows are exposed to a late pasturage, as in the North of Holland, the butter made during the autumn is abnormal, 9226, 9253-4. Experiments showing that early stabling prevents abnormal composition, 9244-55. Results confirmed by a French inquiry, 9256-9; but not by other Dutch experiments, 9247-50. Early stabling may not be the only factor, 9244-52.

A 25 Reichert-Wollny standard would not affect Limburg and North Brabant butter, 9226-30, 9236-7; but the quantity exported is relatively small, 9230. A Reichert-Wollny standard would affect Friesland and South Holland butter only occasionally, 9237. Friesland butter is representative of the greater portion of Dutch butter, 9234, 9238. The relative local production of Dutch butter, 9231-3, 9239-42.

Mr. A. H. ALLEN, F.I.C. (59)

Public Analyst for the West Riding, etc., 9262; other qualifications, 9260-5.

He does not recommend a standard for fat in the present state of analytical science, 9283, 9290,

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* *Continued from the Interim Report which also contains evidence taken in Ireland on the subject of a chemical standard for butter fat (see Digests Nos. 10, 13, 21, and 29).*

Digest of the Evidence.

9358, 9369. If one must be fixed the Reichert-Wollny is the best available, but it is not good enough for a standard, 9278, 9283; alone, or with others, 9279, 9284.

An official standard would bring about uniformity of analytical procedure, 9320; and it would be a boon to analysts, 9358; but a low (*e.g.*, Reichert-Wollny) limit would legalise adulteration, 9321, 9359-60, 9391; and a high one would exclude some genuine butter, 9321, 9367; unless its origin was known, 9322-6, 9360-2, 9388. A high limit would improve the quality of butter, 9367; a low one (*e.g.*, 20 to 22 Reichert-Wollny) would do more harm than good, 9369-71, 9383.

A (24 or) 25 Reichert-Wollny limit could be complied with except by some foreign butter, 9371-3; but it would lead to much litigation, 9373; and the public analyst would suffer, 9374-82. A 25 Reichert-Wollny limit would abolish the addition of *small* quantities of margarine, 9383; but it would not be easy to detect a butter, manipulated from, say, 32 to 25 Reichert-Wollny, even with collateral methods which the analyst would not be inclined to use if the Reichert-Wollny standard was the official one, 9385-91. Colouring margarine would prevent butter adulteration at once, 9282.

There is no dietetic objection to butter with a low Reichert-Wollny value, 9279-82. The dietetic value of milk deficient in cream, 9279-81, 9317-23, 9365; and of butter with added margarine, 9280-82, 9344-6; and the analogy as regards a standard. The milk standard has checked fraud, 9363-4; and improved the quality of milk, 9366.

The composition of butter fat as distinguished from other fats, 9268-72, 9312-3, 9326-8. The various analytical processes give results which are comparable; analyses may be accurate, but the conclusions are troublesome on account of the natural variation in the composition of butter, 9273. A method is required which is not dependent upon the amount of the volatile or soluble acids, 9273, 9291; *i.e.*, a process not for determining butter fat, but the foreign fat in butter, 9274. The discovery of such a method is not unlikely, 9275, 9292-3; research is desired, 9291; but it cannot be undertaken without Government aid, 9276-7.

The existing analytical methods check adulteration, 9314-5; but they do not indicate small proportions of added margarine, 9315-6. The Reichert-Wollny method is the best, 9278, 9283. The microscope does not detect moderate adulteration, 9285-6; and personal error is greater than with chemical processes, 9288-9. The refractive index, and the specific gravity, methods do not help, 9273, 9287-8, 9351-2. The detection of adulterated butter through the abnormal quantity of stearic acid is complicated by the constant occurrence of palmitin, 9326-43. The iodine absorption process will not detect 20 or even 30 per cent. of margarine with certainty, 9347-52. Cocoa-nut oil, 9269; and palm-nut oil, complicate butter analysis, 9271-2.

The Danish Government invited him in 1888 to investigate cases of genuine butter giving low Reichert-Wollny figures at certain periods, 9265, 9294-9304, 9355-6. They were probably due to exceptionally bad conditions, 9303; which have since been altered, and Danish butter is now of average condition throughout the year, 9305-11.

The ordinary farmer does not adulterate systematically, 9367-8. Butter varies from 25 to 32 Reichert-Wollny (average about 28), 9384.

Mr. W. COLLINGWOOD WILLIAMS, B.Sc. (Lond.). (60)

Nominated by the Association of Municipal Associations, but gives his own opinion only, 9392-6.

He does not think it is possible to fix any statutory limits for determining the presence of foreign fats, because genuine butter varies so widely, 9397-8, 9401, 9436. The terms of the Reference are not sufficiently comprehensive, 9490-8; and the practicability of Regulations is doubtful, 9499-504. A low standard would legalise adulteration, 9403, 9411, 9542-7; and a high limit would be unjust, 9411-2; but any standard should be above Reichert-Wollny 25 to do any good, 9437, 9440-2, 9543-7. The absence of a standard deters adulterators, 9545-7. The proportion of adulteration possible, 9443-9.

If a standard must be fixed, he would not rely on any single analytical method, but on as many as possible, 9399. The Reichert-Wollny process could generally serve as a "sorting" method, 9400. It might not be applicable in all future phases of adulteration, 9401. Official tests selected as standards would become stereotyped, 9505-13. He does not use the Reichert-Wollny process, but calculates the volatile acids in terms of butyric acid, 9413-35, 9447. 4·5 per cent. of butyric acid is a common figure in the winter, 9413; the equivalent Reichert-Wollny number is about 25·5, 9430-3; but he has found much lower figures, 9432, 9439-40. Reichert-Wollny 25 is not infrequent, 9437; in the summer it goes up to 30 or 32, 9438, 9446-7. The refractive index of butter (obtained by the Abbe-Zeiss large refractometer), 9450-64. Further research is required for detecting adulteration, 9404-5; suggestions, 9406-10. A permanent scientific research committee should be appointed to direct public analysts, 9514-24. Lactation has an influence upon the amount of volatile acids, 9465-89.

Margarine should be ear-marked, *e.g.*, with sago-flour, 9525-30; and sesame oil, but there are objections to its use, 9526-41. The question of "origin" and the analyst's certificate, 9550-5. Irish samples, 9469, 9548-51.

Mr. E. W. T. JONES, F.I.C. (61)

Public Analyst for Staffordshire, etc., 9556; qualifications, 9557-9.

An official standard would facilitate the analyst's work, 9560, 9619; but from a public point of view, 9619; it is not desirable to fix one, 9560, 9579-82, 9695-6. It is unsatisfactory, as the milk standard proves, 9561-9, 9586-98, 9620-9, 9634-52. It does more than "raise a presumption," 9562; it is rigid in a court of law, 9618. A magistrate would disregard the analyst's certificate, 9630-3; if the butter was up to the standard, 9652-64, 9680-1. A case may be taken to a higher Court (which is an expensive process), 9665-6; and the Government Laboratory certificate can be obtained to make a standard effective, 9667-74, 9678. There is no appeal to Quarter Sessions, if prosecution fails, 9675-9*.

An unofficial standard is preferable, 9560-1, 9593-619, 9624, 9682; and some chemical method of accurately determining the amount of foreign fat is required before an official test is adopted, 9580-5. If a standard must be fixed it should be dependent upon the volatile acids, 9575, 9577-8. He would recommend a composite test, viz., the Reichert-Wollny coupled with the valenta and refraction tests, 9575-6. A 25 Reichert-Wollny standard would not touch colonial butter, 9714-6; and it would do no substantial injustice generally, 9706, 9711; one of 24 Reichert-Wollny certainly would not, 9711, 9716-7. A low standard would encourage adulteration, 9579, 9598, 9694; a high one would be unjust, 9603, 9691-3. The existing methods of analysis check butter adulteration, 9688; and it will be a public declaration of weakness if the Committee do not prescribe some limit, 9685-91.

The various processes of butter analysis and the methods he employs, 9570-4, 9683-4. The addition of "remarks" by an analyst on his certificate, 9620-30. The average Reichert-Wollny number of butter is from 24 to 25, 9700; and of the butter sold in Staffordshire, 9697-718; where much English butter is sold, 9712-3, 9716; 98 per cent. would pass a 24 Reichert-Wollny standard, 9697.

Mr. ALBERT RIPLE. (

Agricultural Agent to the Norwegian Government in Great Britain, 9719-24.

It would be very difficult to fix a reliable standard for fats, 9887-8. A 25 Reichert-Wollny standard would affect the export of Norwegian butter during the summer, 9745, 9866-7. Any Reichert-Wollny number would injure Norwegian butter, 9889.

Variation in the composition of Norwegian butter: official inquiry, 9725, 9748-55. The Government Laboratory has found that the analytical figures lie considerably beyond those formerly supposed to be the limits for genuine butter, 9730-2. Tables giving refraction, and Reichert-Wollny figures from 21·1 to 34·9, 9726-32, 9748-55. The Reichert-Wollny test mainly relied on in Norway, 9729. The Reichert-Wollny, iodine, and refraction values vary with the season, 9730. The difference between the Reichert-Meissl and Reichert-Wollny numbers, 9734-6.

The effect of the period of lactation, 9730; food, 9730, 9745-7; and temperature, 9730, 9747, 9824-5. Low Reichert-Wollny values attributed to cold, rain, and snow, 9730, 9798-826; and to the cows being turned out to pasture, 9730, 9745-7, 9794-826, 9829-31. It would be difficult to change the methods of pasturing cattle, 9746, 9800-3. A higher specific gravity and Reichert figure found at all the dairies during the winter than during the summer, notwithstanding the condition of the cows, time of calving, and the weather, 9730. Some of the finest butter is made on farms at a high altitude, 9745.

The Norwegian Margarine Act of 1886 raised the presumption of adulteration at 12·25 cc. Reichert-Meissl (almost 25 Reichert-Wollny), 9733; but the figure has been rebutted by subsequent inquiry, 9737-8. The new margarine law regarding admixtures, 9739-41, 9835-43*.

Norwegian butter: methods of production, 9756-7, 9778-92, 9882; of exportation, 9758-65. The exports of butter, 9742-4, 9832, 9853-9, 9879-82; maximum in the spring, 9860-1; minimum in the summer, 9862-70; when the Reichert-Wollny figure is low, 9864-7. Butter importation, 9871-3. Margarine is manufactured, 9766-78; and exported, 9844-52. Number of cows in Norway, 9874-8.

Mr. HARALD FABER, F.I.C. (63)

Commissioner to the Danish Government, 9885.

The Danish Government are opposed to a standard based upon any known chemical tests for fats, 9895-8; because it might exclude some genuine butter, and induce adulteration, 9898-900. A low standard would be very serious, 10093. A standard would involve great difficulties, and it would be unjust, 10026; independently of Siberian butter, 9991; because there is no connection whatsoever between the quality, or the price, of butter and the chemical analysis of the butter fat, 9903-5, 9916-23, 9991-3. The milk standard is not analogous, 9916-7, 9991-2, 10029-34.

The export of Russian butter, 10102; viâ Denmark, 9933-42, 9981-9, 10004-21; is considerable, and a standard would, in this connection, affect Danish merchants, 9995-7, 10092-108; whom he also represents, 10094-106. A high standard would not touch Danish butter, 10091, 10099. A high standard would affect it less than other butter, 10035-6; because it is more uniform, and can be more readily traced, 10037; through the method adopted by H.M. Customs and the Danish authorities, 10038. The identification of Danish and other butter exported from Danish ports, 10039-90.

A system of control as an alternative to a chemical standard: the trade mark adopted by 700 Danish dairies, 9998-10002. The Danish Government would join an international organisation, 10003. The official control of Danish butter, 9946-7, 10038, 10086. Ear-marked Danish butter, 9989-90.

The difficulties of determining the genuineness of butter, 9301-2. A test for foreign fats in adulterated butter would be most beneficial to traders and producers, 9906; and it would do away with the necessity for a limit, 10027-34. Prize offered by the Royal Danish Agricultural Society, 9906-11; without result, 9909. A desired test may still be discovered, 9911-5.

Abnormal butter, below 25 Reichert-Wollny: tables showing 26 out of 108 samples of Russian butter exported to Denmark, 9924-43; and 449 samples of Danish dairy butter, 9944-67; or 2 per cent. of total samples analysed, 9951-7, 10022-5. This Danish butter appears in the autumn, 9958-9; the period varies with the temperature, 9959, 9962; and the crops, 9950. The effect of food, 9962; the period of lactation, 9962-80. Uniformity of butter production obtained by uniformity in system of calving, 9973-6; which cannot be adopted in Siberia, 9977-80. Co-operative dairies are increasing in Denmark, and they make the butter more uniform, 10110-3. The Danish Margarine Act, 9947.

Mr. OTTO HEHNER, F.I.C. (64)

Delegate of the Institute of Chemistry, and the Society of Public Analysts, 10015-6; qualifications, 10117-8, 10165-9.

It is undesirable in the present state of science to adopt a standard, 10153, 10198; best to allow the analyst a free hand, 10199-200. It would be most inopportune to lay down any limit based on existing tests, 10155; but some system of verification would be useful, 10179. The existing methods of analysis are not satisfactory, 10153-4, 10221-5; new methods are required, 10155, 10162; and the details should not be published, 10163-4, 10200.

There is no connection between the composition of butter and its commercial value, 10156, 10187-97; a chemical standard is therefore not tenable, 10156; as in the case of milk, 10156, 10187-9; and of the proportion of water in butter, 10157-61, 10170. Butter adulteration is not as prevalent as formerly, 10170-1, 10201; partly owing to the analyst, 10172-8, 10176-9; the large butter supply, 10174-5; and the law, 10202. A historical sketch of the progress of butter analysis since 1873, when there were practically no mixtures, 10119-25. The Hehner, Koettstorfer, Reichert methods, 10119-20, 10127-30, 10208-25; specific gravity, 10120. The iodine absorption process, and refraction test, 10121; are of little use, 10154. Methods which were valuable for the detection of large quantities of added margarine broke down with the development of adulteration, 10121; and began to be discredited about the year 1889, 10122-5.

The effect of climate, and of keeping cows out late in the year (recent experiments in England), cows stabled at the right time give a higher Reichert-Wollny figure, 10151-2. The number of abnormal imported butters is comparatively small, 10180-3. Irish, 10125, 10203-7; Dutch, 10125; and Siberian, of which much is exceptional, 10126-40; especially during the autumn, 10141-6. Siberian butter does not introduce a new factor in butter analysis, but it accentuates an existing one, 10147; the quantity imported, 10147-50. Finland butter gives almost always a low Reichert-Wollny number, 10145. Abnormal Colonial or Argentine butter very rare, 10181-3. Abnormal samples mainly come from countries where the cows are exposed to severe climatic conditions, 10184; which can to some extent be remedied, 10185-6. A reasonable limit, if it can be found, would check abnormality, 10186. A fair average Reichert-Wollny figure for butter generally is 29, 10130-1, 10137.

Dr. BERNARD DYER, D.Sc. (Lond.). (65)

Delegate of the Institute of Chemistry and of the Society of Public Analysts, 10226; qualifications, 10236-40, 10263-5.

The Council of the Society of Public Analysts are opposed at the present time to the fixing of any limits for the composition of butter fat. The methods known do not suffice to satisfactorily discriminate between butters of variable origin and admixtures of genuine butter with moderate quantities of foreign fat, 10231, 10235, 10278, 10283. This is also Dr. Dyer's individual opinion, 10232-4, 10240, 10284. The Council strongly urge a special experimental inquiry to discover a new method of analysis, 10234; with hopeful results, 10284-6.

The Society took steps to obtain the opinion of the members in general, 10227, by means of a circular, 10228. Analysis of the replies received:—Circular sent to 240 members, about 80 holding appointments under the Sale of Food and Drugs Acts: 61 replies received, including 43 from public analysts; 34 public analysts, and 11 other

Digest of the Evidence.

analysts, *i.e.*, three-fourths of the members who replied favoured the fixing of a legal standard, but with very variable views, 10228-30, 10244-62, 10272-83. A few of the public analysts are not members of the Society, 10280-2. The frequency of abnormality in Dutch and Siberian butter, influenced the Council in their decision, 10235. The terms of their resolution, 10241-3.

The relative extent of butter adulteration, 10266-71. It is difficult to differentiate between abnormal and adulterated butter, 10269. A 24 Reichert-Wollny standard would be disastrously low, and would encourage adulteration, 10274-5.

Mr. E. N. F. FENWICK. (66)

Magistrate, Bow Street Police Court, 10287-8.

The presence of foreign fats in butter, 10305-7.

The Regulation fixing a 16 per cent. standard for water in butter will facilitate legal procedure, 10292-3, 10346-7, 10378-80; because it defines what is genuine butter, 10338; and vendors, in the poorer districts, *will not* give notice, 10381.

The sale of butter containing an excess of water, and the question of sufficient notice to the purchaser, 10296-302, 10308-29, 10335-45. As regards milk-blended butter, 10303-4, 10369-76; and when genuine butter is sold in the same shop, 10327-8, 10382-4. A printed notice in the shop, 10315-26; or on the wrapper, 10323-5, 10385; r. a verbal declaration, 10324. If the disclosure be sufficient the case ends, 10343.

The Regulation does not deprive a man of any defence he might have had before its issue; the principle of disclosure implied in the Act of 1875 is continued under the Act of 1899, 10320-2. The standard shifts the burden of proof upon the vendor, 10330. There are two entirely separate, 10351, 10358; means of defence, viz.: (1) the disclosure, and (2) the question of genuineness, 10336-7. The term "genuine," 10352-5. Butter made in the ordinary way, and subsequently "manipulated" is not genuine, although the standard be not exceeded, 10356-8, 10369-70. If notice is given the question of genuineness does not arise, 10369-74.

The analogous case of milk, 10359-66; the purchaser has the right to expect the *bonâ fide* article, 10359; but this question is complicated by a recent decision that "skimmed milk" is "milk," 10361, 10375-6. Two samples of genuine fresh milk mixed together (one being below the standard) would not constitute "adulteration," 10366.

The standard will not protect adulterated butter, even if it is within the limit, 10348-51, 10357-8, 10369. A magistrate has power to allow costs to a successful defendant, 10331-4. A standard would simplify legal procedure if butter containing more than 16 per cent. of water was not sold as butter, 10367-8. The London police magistrates hold quarterly meetings to discuss *inter alia* the question of uniformity of procedure, 10386-7.

Dr. W. H. WRAY. (67)

Representative of the U.S.A. Government, 10388-92.

Makes no recommendation regarding a chemical standard for butter, but his Government will abide by the Committee's decision, 10393; and will comply with any conditions required, 10398-401, 10469. International legislation would be difficult, 10397-401.

Dairy legislation in the United States, 10395. The standard for water in butter, 10394, 10421-5, 10443, 10451. Adulteration is illegal, 10413-6; the Adulteration Act covers exported butter, 10444. A new Bill *re* compulsory inspection of exported butter, 10395, 10434. Government inspection and branding of butter, 10395-6; the recognition of the official stamp in England is requested, 10397, 10402-9. Branded butter could not be easily ear-marked beyond the port of entry, 10398-400, 10407-10. The system of branding butter for export, 10411-2, 10431-69; inspection is voluntary, 10432, 10435, 10463; unbranded butter is not necessarily pure, 10433, 10435-6, 10462; branded butter is pure, 10437-40; and uniform, 10454. Process butter, 10417-20. Boracic acid in American butter, 10459-63.

The relative price of American butter at home and in England, 10426-30; of branded and unbranded butter, 10470-5. The quantity of butter imported into the United Kingdom from the United States is relatively very small, 10477-10484.

REPRESENTATIVES OF THE GERMAN GOVERNMENT.

Professor Dr. VON BUCHKA. (68)

Member of the Imperial Council of Health of Germany, 10487-8, 10524.

The difficulty of fixing chemical limits for the constitution of butter, 10503-6, 10552-3. No opinion expressed on behalf of the German Government as regards a (*e.g.*, Reichert-Meissl) figure, 10553.

There is no official limit in Germany for the constituents of butter, 10494, 10521; except for water, 10494, 10496-502, 10528, 10546. A limit for salt will be fixed, 10497, 10528-9. The legal definition of butter in Germany, 10495; it must always contain 80 per cent. of butter fat, 10498-502. It has not yet been possible to fix chemical limits, 10503-5; but there are official regulations, 10504-7; which are promulgated as law, 10508-14; and indicate in effect when a presumption shall be raised that butter is adulterated, 10524-7. They allow the chemist to choose the method of analysis, 10507, 10509, 10515.

The official regulations for butter analysis in Germany, 10506-7, 10516-21, 10524, 10533-41. The refractometer is employed as a preliminary test, 10516-7; to be followed by a chemical analysis, 10517-8; and the determination of the volatile and soluble acids, 10519; by the Reichert-Meissl or Leffmann Beam methods, 10520. Uniformity of practice among chemists is also fostered by the unofficial standards and methods of an Association of chemists, 10522-4.

The determination of constituents which cannot be saponified, and the detection of sesame oil and other vegetable fats, 10533-42. The Reichert value for genuine butter, 10524-5, 10530; few butters below 24, 10530-3. Dr. Bömer's method of testing for phytosterin as a means of detecting foreign fats in butter, 10533, 10539-42. The amount of adulteration which can be detected, 10542-4.

The German Margarine Law, 10534, 10541; prosecutions in Germany, 10545-6. Butter preservatives, other than salt, not allowed in Germany, 10530. Experiments on feeding sesame oil cake, 10539. The German export butter trade is small and decreasing, 10549. The Hamburg control system, 10547-51.

The term "Reichert-Meissl number" in his evidence is synonymous with the "Reichert-Wollny number," 10909-12.

The German Government would co-operate in an international agreement regarding the control of exported butter, 10991-2.

Professor Dr. P. VIETH. (69)

Principal of the Hameln Dairy School, etc., 10489, 10913-4; formerly analyst to the Aylesbury Dairy Company, 10915-7.

It is most difficult to fix a limit for the fats in butter, 10969, 10978-80, 10988-90; a *minimal* limit is useless, 10990. The Reichert-Wollny process is the best available, 10971. Butter giving a number below 25 or 24 should be regarded as very suspicious, but hundreds of cases of genuine butter below 24 occur every year, 10971. The analogy as regards the milk standard, 10981-8. It would not be unjust if a presumption were raised when butter falls below 24 Reichert-Wollny, 10972-3, 10982; or inconvenient, if a certificate of origin could be devised, 10974-7. There is no standard in Germany for the volatile acids, 10968.

The chemical composition of butter, 10919. Experiments made in England, 10921-7, 10965-7. The Reichert-Wollny number 25, or above, from

April to July, and below from August to March, 10923. No essential difference between the fats of English and other butter, 10920-1; in the butter from different breeds, 10923; or from cows of different age, 10924-5. There is no evidence that difference of feeding has any effect, 10923, 10939-41, 10966-7. When cows are getting dry the volatile acids in the fat are, as a rule, very low. This is the only well-established fact on the whole question, 10926-7, 10937-8, 10949, 10962.

Much German butter gives low Reichert-Wollny values in the autumn (analyses), 10927-59, 10968. Dr. Vieth does not quite agree with Dr. van Rijn (see Digest No. 58) as regards the effect of inclement weather, 10942-56; because there is no marked difference in the volatile acids when the cows are turned out *early* in the year, 10956-9. The physiological reason is not known, 10960-4.

Mr. G. LEWIN, F.I.C. (70)

Superintending Analyst, Government Laboratory, 10554.

Strongly recommends the adoption of 24 Reichert-Wollny as the official standard, 10653-9, 10707-8, 10726-7, 10736, 10742-3; for butter in general, 10681. No other test is suitable, 10737-8, 10775. Abnormal butter should not be considered in this connection, 10657, 10660. This standard would not encourage adulteration, 10683; and it would make imported butter more uniform, 10671. The standard should be fixed without delay, 10673; as there is no likelihood of immediate improvement in butter analysis, 10674-9, 10704; but it could be modified hereafter, if necessary, 10704-6. An analyst should not be debarred from using supplemental tests, 10708-11, 10728, 10771-6.

The applicability of various chemical and physical tests for determining the genuineness of butter: (1) The refractive index is useful as a corroborative test, 10555-9, 10669, 10738. (2) The iodine number is of no value at all, but rather obscures the issue, 10560-1, 10775. (3) The specific gravity of the butter fat is a very important criterion, 10562-3, 10669, 10776. (4) The determination of the soluble and insoluble acids is a valuable corroborative test, advisable in doubtful cases, but there is a large personal element in its application, 10564-6, 10695-9. (5) The determination of the volatile acids by the Reichert-Wollny method is the best available means of fixing a standard, 10567, 10698. This method and the specific gravity "hang together," 10776. (6) The molecular weight of the insoluble fatty acids may be useful in future, 10569. (7) The Koettstorfer number is valuable and a corroborative test, 10669.

Analyses of representative samples of butter produced in the United Kingdom, 10568, 10700; under various conditions which may affect the character of butter, 10569-75, 10578-80, 10582-91, 10594-600. The samples were sent from 40 places, 10576; viz., 14 in Scotland, 10577-80; 14 in England, 10581-91; and 12 in Ireland, 10592-3. The English and Scotch samples were obtained mainly from individual farms, 10596; and the Irish samples from co-operative creameries, 10594-600. Monthly samples were supplied, 10601. Particulars relating to breed, feeding, period of lactation, etc., 10602-15, 10752-9.

The analytical procedure adopted, 10616, 10669. (1) The method of testing for water, 10616-7; the proportion of water in the English, 10618; Scotch, 10619-28; and Irish samples, 10629. Of 311 samples, five were above 16 per cent., 10631-4. (2) The proportion of salt ranged from 3·5 per cent. to *nil*, 10635-6. (3) The amount of curd was rather low, and not very variable. It can apparently be reduced almost to a minimum, 10637. (4) The average percentage of butter fat was 84, 10638.

Variation in the Reichert-Wollny value of the English, 10640; Scotch, 10641-50; and Irish samples, 10651-65. Anomalous figures given by butter from experimental farms, 10585-7, 10640, 10730-1, 10747-9, 10765; the East and West Ridings County Council farm, 10589-91, 10760-6; and the Midland Dairy Institute, 10712-5. Abnormal Scotch, 10641-50, 10742-51; and Irish samples, 10600-15, 10651-5, 10701-3, 10719-25, 10768-70. The Reichert-Wollny figure of Irish butter is naturally a little lower than English or Scotch, 10600, 10735. The proportion of volatile acids is higher in Scotland than in England, 10641, 10754. Very few samples below 24 Reichert-Wollny, 10641, 10656, 10729-35, 10740-1; indicating butter produced under exceptionally unfavourable conditions, 10657

Digest of the Evidence.

The production of normal butter is affected at the period when cows are taken in and out of doors, 10604-8, 10611-2, 10718-25; and by extreme heat as well as excessive cold, 10758-9. The period of lactation is an insignificant factor in determining the proportion of volatile acids, 10608-10, 10640, 10716-7, 10733, 10767. Normal butter is produced universally under proper conditions of comfort and feeding, 10610, 10685. The great factor, 10758. Low Reichert-Wollny figures can be prevented by good methods of dairying, 10640; and of stabling under severe climatic conditions, 10685-7, 10720. The character of butter from cold and warm climates does not vary materially, 10570, 10692-4. Dutch butter is a doubtful exception, 10671. Norwegian, Swedish, and Russian butter only rarely abnormal, 10660-8, 10671-2; analytical data, 10662-5, 10687. They would not be affected more than British butter by a 24 Reichert-Wollny standard, 10666-7, 10681.

Objects to the assertion that there is no connection between the Reichert-Wollny number and the commercial quality of butter, 10688-91.

Mr. J. F. WATKINS, J.P. (71)

Chairman of the Watford Bench, 10777-80.

A standard for butter-fat would be useful to magistrates, 10807-11.

Prosecutions for excess of moisture in butter, 10779-806, 10815, 10871-908. Where a sufficient disclosure is made, with no intention to deceive, there is no offence, 10784. If ample "notice" is given it does not matter how much water there is in the butter, 10790. The effect of the Butter Regulations for excess of water, 10788-806, 10816-31, 10861-2, 10877-82, 10894-8; they make no alteration in the law, 10816-8, 10852. Two defences are available: (1) the notice to purchaser; and (2) evidence that the butter is genuine, 10815-31. The Regulations useful as regards (2), 10826-9, 10861. If a purchaser is not deceived the Regulations do not come before the Court, 10819-31. If a disclosure is made the purchaser is protected by section 6 of the Act of 1875, 10861-2; provided there is nothing deleterious, 10863; and excepting revenue articles, 10864; and margarine, 10865-8. The meaning of "sufficient disclosure," 10873-6, 10883-91, 10899-908.

The adoption of a distinctive name for "butter" containing more than 16 per cent. of water, 10798-806. "Milk-blended butter" should not be sold as butter, 10870. The Herts County Council desire an alteration, which no Regulation can make, in the law, 10832-3, 10845, 10857-60, 10892-3; a legal definition of butter is required, 10834-5, 10839-40, 10868-9; as in the case of whisky and tobacco, 10836-8. Butter and milk are the only two non-excisable articles which require this protection, 10841-2. The analogy as regards articles of revenue, 10846-52; and drugs, 10853-6.

Mr. W. F. KEATING STOCK, F.I.C. (72)

Public Analyst for the County of Durham, etc., 10993-5.

Approves of the Regulation for water in butter, 10996; which will facilitate legal procedure, 10997. Recommends a 5 per cent. limit for salt, 10998-9. A misunderstanding exists regarding boric acid, 10999-11003.

An official standard would "clear away an enormous difficulty," 11023; and a fixed and definite limit would be of great advantage, 11112. The milk standard analogy, 11043-5, 11060-5, 11071-2.

Recommends a composite standard, viz., by the Reichert-Wollny and the Hehner methods, 11024-6, 11113-5; although there is an objection to these two tests only, 11030. Their relation is practically direct, 11027-9; but they cover different ground, 11113-9. Suggests 11 Reichert (*i.e.*, 22 Reichert-Wollny) as a fair limit, 11039-40, 11065-72, 11083-7, 11137-41; at any

Digest of the Evidence.

rate for some time, and provided an allowance is permitted as regards the country of origin (see next paragraph), 1103741. If, however, this suggestion "falls to the ground," 11056-9; he would raise the limit provided it can be fairly done, 11073-9, 11087, 11140-1. A 24 Reichert-Wollny standard would be quite fair if local authorities were empowered to make preliminary inquiry in cases where the Reichert-Wollny figure approximates the limit, 11146-50. It would not be necessary to ear-mark butter *re* origin if the limit is sufficiently low, 11055, 11137, 11150; but a low limit would foster adulteration, (11033), 11059, 11150.

Butter is not naturally deficient in normal constituents to any large extent, 11004-6; but butter from various countries differs very considerably, 11005, 11017, 11047-59, 11136. The difficulties of the analyst which ensue, 11005-18, 11022-3, 11128-33. The country of origin should be marked on every parcel of foreign butter, 11006-7; before it comes on the market, and when it is retailed, 11008. The analysis should be undertaken without any knowledge of "origin"; and an allowance, according to the analyst's judgment could afterwards be made (but see especially 11055-6 and 11088) 11008-18, 11037, 11050, 11078, 11123-6, 11134-7. He would, however, require other particulars also, 11081-8. The milk analogy, 11013, 11126. Accurate information regarding the average composition of foreign butter could soon be collected, 11009; the necessary allowance would be of rare occurrence, 11014-5; and it could be specifically set out in the official Regulations, 11016.

The chemical tests which he employs in analysing butter, 11022. The Hehner process, 11120; is tedious, but it has many advantages, 11116-22. The Reichert-Wollny and Reichert-Meissl processes, 11020-2, 11136. The introduction of cocoa nut oil into butter complicates matters immensely, 11041. A valuable test, 11042-3.

The Reichert-Wollny number of 105 samples of *commercial* butter ranging from 21 to 32, 11019, 11066-9, 11080, 11094-103; other chemical data, 11022. The Reichert-Wollny number in samples of butter *known to be genuine* ranging from 25 to 34, 11103-11. 88 per cent. of his samples, which are mostly English, drop well within the limit of genuine average butter, 11051-2. His lowest Reichert-Wollny figures for various foreign butters, 11136. Abnormal butter occurs wherever cows are subjected to the Friesland conditions, 11053-4. The limit would be more applicable to imported butter than to individual British samples, 11089-93, 11142-5.

Mr. HUGO WEDIN. (73)

Commissioner in Great Britain for Sweden, 11153-9.

Suggests a system of control as a means of guaranteeing the purity of butter, 11156, 11181-8. The Swedish Government's effort to mark exported butter, 11206-8.

The Swedish Margarine Law, 11161-5, 11175, 11212-5; and trade, 11177-80. The export butter trade commenced in 1864, 11174; it is decreasing slightly, 11175. The districts whence exported, 11169-70, 11205, 11208, 11217; about half is sent *viâ* Denmark, 11171-3, 11193-6, 11209; of which nearly all come to England, 11172-3, 11189-90; some of it is marked as Swedish, 11191-2; but the rest may be sold as Danish butter, 11197-205, 11210-1, 11221. How Swedish butter is entered at the English Custom House, and sold, 11218-24, 11233-5.

The Swedish method of dairying, 11225-30; the qualities of the butter exported, 11205, 11208, 11236-9. The purity of Swedish butter, 11167-8, 11181, 11215-6. Professor Nilson's investigations relating to the volatile acids in Swedish butter, 11160, 11231-2.

Mr. J. KEAR COLWELL, F.I.C. (74)

Analyst for Borough of Holborn, etc., 11240-1.

Approves of the Butter Regulations for water in butter, 11244-5; and recommends in the public interest, 11250, 11278, that official standards should be fixed for the other constituents, 11246, 11273; although low limits must be fixed, 11247-9. He suggests two tests, 11254, 11276-8; viz. (1) the Reichert-Wollny figure of 24·5, 11253, 11255, 11274; and the Hehner number 89, 11253, 11256, 11275. The vendor should have the benefit of the more favourable figure, 11257-8; other tests might be admitted as evidence, 11262. These two tests are the best available, 11263; and the discovery of better ones is unlikely, 11264-7. An official standard would be beneficial, 11259; abnormal butter would be weeded out by a 24·5 Reichert-Wollny limit, 11278-9. It would not be a hardship because abnormal butter is infrequent, 11292-303. The majority of analysts desire a standard, 11310-1.

The effect on the character of butter of lactation, 11260; feeding, 11261; and stabling, 11280-91, 11303. Recent increase in butter adulteration, 11251, 11304-9, 11314-6; the analyst's difficulty, 11251-2; in the determination of small admixtures, 11251, 11268-72.

Major C. E. CASSAL, F.I.C. (75)

Analyst for the Borough of Kensington, etc., 11323; other qualifications, 11323-8.

A standard for butter-fat can and should be fixed, 11333, 11368, 11383; as in the case of milk, 11335-7, 11383. A standard is necessary for the guidance of magistrates and analysts, and for the protection of the public, and sellers of genuine butter, 11334, 11377, 11387-8. The majority of analysts are in favour of a standard, 11378-9. The absence of an official standard permits adulteration, 11383; and has caused miscarriage of justice, 11388.

Recommends that a presumption be raised that a butter is not genuine when it gives (1) the Reichert-Meissl figure, notably below 12; (2) the insoluble fatty acids figure notably above 89; and (3) an adverse Zeiss refractometer indication, 11339-44, 11373-6, 11380-3. Recommends especially (1) and (2), 11392.

A double standard would not seriously increase legal difficulties, 11380-2; but for the sake of uniformity of analytical procedure which conduces to the interests of justice, 11351-2, 11364; he does not consider three tests of vital importance, 11358. The Reichert, 11340-2 11346, 11353, 11362-3; and Hehner methods compared, 11343, 11389-91. The Reichert process more delicate *re* adulteration; the Hehner method more likely to produce correspondent results, 11390; the determination of the soluble fatty acids not necessary, 11393; but only the insoluble fatty acids, 11394. A double chemical test is likely to be less mechanically employed by the analyst, 11343-54. An absolutely rigid official process alone is undesirable, 11354-6; *e.g.*, Sikes' hydrometer, 11357. An analyst should be allowed to obtain his results by the process he considers desirable, 11358, 11360-2; results obtained by different methods are closely concordant, 11363.

He has never found a lower figure than 12 Reichert-Meissl (24 Reichert-Wollny) in genuine butter, 11365-72. A 24 Reichert-Wollny standard would be an extremely lenient one, 11373-4. Opposed to a low limit which would include abnormal butter, because it would introduce a vast amount of adulteration, 11394, 11398. Abnormal butter can be prevented, 11398.

A difficulty of fixing standards is due to the too wide meaning of the term "genuine." it should be restricted to butter, the characters and composition of which fall within the limits which have been arrived at by repeated analyses of the normal article obtained under normally healthy and proper conditions, 11387, 11394. Producer and vendor are legally bound to supply the normal article, 11394; *e.g.*, Dyke *v.* Gower, 11395-8.

Mr. F. J. LLOYD, F.I.C. (76)

Representative of the Bath and West and Southern Counties Society, and of the British Dairy Farmers' Association, 11399-405; and analyst, 11420-3.

The two societies which he represents approve of the 16 per cent. standard for water in butter, but object that disclosure of an excess is sufficient, 11405-19, 11570-4. The law should be altered, 11578-82. They are in favour of a single standard, although a dual one was recommended to the Food Products Committee in 1896, 11559-69, 11597-603. If the sale of butter with more than 16 per cent. of water is permitted, butter with *e.g.* 40 per cent. of water will be made, 11575; with a certain machine, 11576-86.

He is not in favour of a public standard for butter fat, but there should be an official Court of Reference consisting of experts who would issue directions privately to analysts, 11587-93. If a chemical standard is adopted it should be a high one, so as to minimise adulteration, 11515.

It is very difficult to determine when butter is genuine, 11455-7, 11522, 11551-4, 11557-8. Tests by the B.D.F.A., 11523-31. Occasional samples of butter give low Reichert-Wollny numbers, 11516-22. The majority of butter contains 6 per cent. of volatile fatty acids, 11530; 5 per cent. is the lowest in genuine butter, 11556. The chemical constitution of butter from different localities differs naturally, 11436-7; owing to climate, breed, period of lactation, stabling, and food, 11438-40, 11596. Butter made at dairy schools, 11441-6. Any butter, *e.g.*, Siberian, which is abnormal, should be compulsorily labelled so as to escape prosecution, 11570-4. Analyses of butter made in 1888-90, 11424-34, 11522.

The methods of butter analysis: improvement during recent years, 11461-2: the Reichert process and its objections, 11463-92. (The Society of Public Analysts have proved that the Reichert-Wollny process yields concordant results, 11478-85, 11509-10.) The method adopted in his laboratory, 11456-7, 11467-74, 11530-2. The amount of volatile acids and the rate of distillation by the Reichert-Wollny method, 11489-92. A better method than the Reichert-Wollny is to distil "the whole of the volatile fatty acids," 11492-507, 11536-50; its advantages, 11508-14, 11532-5, 11547-50. Cream adulterated with starch, 11447-53.

Mr. C. ESTCOURT, F.I.C. (77)

Public Analyst for Manchester, etc., 11604-8; represents the Manchester Corporation, 11609-11.

Approves of the 16 per cent. standard for water in butter, 11616-7, 11752-5; (18 per cent. for salt butter, 11755). He is also in favour of a chemical standard for butter fats, 11614-5, 11618, 11627, 11635, 11683-4, 11756; which is necessary, 11619; to protect analysts and the public, 11719-23, 11744; and to facilitate the administration of the law, 11745. The analogy as regards milk, 11623-4, 11682, 11685; the "Clacton case," 11629-34.

Recommends a limit of 4·5 for the soluble fatty acids as the standard, 11612-3, 11636-9; (corresponding to 24 Reichert-Wollny, 11735-41); or any other valid collateral test, 11613, 11637-9, 11731, 11761. He employs the distillation process (for sorting out butters), 11640; and the Reichert method, 11641-2, 11689-734.

The Society of Public Analysts' method of assessing the amount of butter fat in margarine, 11643-5; could be extended as a second test; to determine the amount of volatile acids in butter, 11646-7; but, with all its disadvantages, he would place first the direct determination of the soluble fatty acids, 11648-67, 11687-90, 11702-7. It is not the ideal method for an official standard, 11668-70; which should give uniform results from different analysts, 11685-6. He employs more than one test for butter of poor quality, 11691-701. Under certain circumstances he would select the Reichert-Wollny method, 11708-9, 11757-9; and, if it is adopted officially, he suggests the figure 24 as the standard (11710), 11760.

He would not now, in the absence of a standard, declare butter to be adulterated which was above the figure 10 (with 2½ grammes), *i.e.*, 20 Reichert-Wollny, 11711-8: adulteration with cocoa-nut and cotton-seed oil excepted, 11724-34. A fixed method is desirable for the determination of water in butter, 11662-6, 11685-6.

A standard practically exists now, 11742; but adulteration would decrease by the public proclamation of a limit (of, *e.g.*, 24 Reichert-Wollny), 11620-3, 11737-45. Butter is not necessarily "good" because it has a good flavour, 11746. Butter with a low Reichert-Wollny figure is inferior from a chemical, but not commercial, standpoint, 11747-11751. He would make no exception for genuine butter, which is "abnormal," 11624-34, 11670-82. Few English or Irish samples below 24 Reichert-Wollny, 11765-6.

Official standards would not become stereotyped, but he recommends the appointment of a scientific committee to improve the analytical processes, 11762-4.

Dr. W. R. BISSCHOP. (78)

Hon. Secretary of the Netherlands Chamber of Commerce in London, 11768; gives evidence in his private capacity, 11767-71.

Opposed to any chemical standard for butter, 11817-8; because (1) the methods of analysis are inadequate, 11819, 11825-34, 11837-53, 11858-60, 11917, 11925; (2) the quality of butter does not depend on the volatile acids, 11819; and (3) they cannot be regulated as in the case of water, 11819-23, 11854-7. A standard would encourage adulteration, 11835-7, 11906. The control of butter factories as an alternative to a standard, 11881-928, 11950-9; prosecutions to lie where the butter is made, and not where it is sold, 11904-5.

The "Institutes of Control" for the purity of Dutch butter, 11773-803, 11823-34. They are private institutions, 11778-80; representing factories, 11781-4; with the exception of one which includes traders, 11781-2. The system of supervision, 11783-9, 11790-8, 11824-34, 11947-9; and marking, 11937-41. The butter exported is guaranteed, 11799-803.

The Dutch Adulteration Law, 11809-10. There is no official standard for butter in Holland, 11811-3. The manufacture of margarine in Holland, 11929-30; and the adulteration of butter, 11932-6. Genuine butter giving a low (16) Reichert-Wollny figure, 11837, 11944-6. Friesland butter, 11792-6; statistics, 11804-8; genuineness, 11928. The Dutch butter export trade to England, 11942-3.

Mr. A. E. BROOKE HUNT, (79)

Superintending Inspector to the Board of Agriculture, 11960.

The results of the recent Official Enquiry into the composition of genuine British butter are insufficient as a basis for a standard, 12040-6. It would be extremely inconvenient to keep cows under conditions necessary to produce high Reichert-Wollny figures, 12031.

He assisted in the selection of certain English and Welsh farms, etc., which supplied samples to the Government Laboratory for the Enquiry, 11961-4. The selected places represented the country generally, 11965; the different breeds of cattle, 11965, 11994-5, 12000-18. The soils, 11969. One set of samples was taken from the produce of selected cows, 11956; two exceptions, 11966-8.

Evidence relating to the conditions under which the butter was produced in 1901 at (1) The Midland Dairy Institute, 11970-82; (2) the East and West Ridings County Council Farm, Garforth, 11970-1, 11983-6, 12026-8. The abnormality of the samples, 12057-68; was not due to exceptional circumstances, 11987-93, 12029-39, 12054-6, *e.g.*, experiments, etc., 11991-2; the method of making butter, 11993; or the time of milking, 12076-85. The hot weather, 11990, 12047-8; and the period of lactation, 11966, 11990, 12051-6, 12068-75, 12086; may have been the cause. Low Reichert-Wollny figures were also obtained at the Midland Dairy Institute in 1902, 12019-25.

Particulars regarding other farms, etc., which supplied samples, 11994-12018, 12087-8. Three-fifths of the samples from "Shorthorn dairies" gave low Reichert-Wollny numbers, 12025, 12049.

M. KALANTAR, (80)

Representative of the Russian Government, 12089.

No chemical or physical method is reliable as a standard test of butter adulteration, 12104,

Digest of the Evidence.

12319. A chemical standard for butter would be beneficial, 12229; but it is impossible to fix one at present, 12229-33, 12323, 12430-3. A standard varying with the period of the year, 12105, 12436-7; would be impracticable, 12232. The question of a standard should be settled by an international conference, 12103, 12233, 12319-23, 12476-8.

The Reichert-Wollny method is the best, 12233; but it is not sufficient for a standard, 12321, 12476-82. The Reichert-Wollny No. of butter does not indicate its commercial value, 12235, 12315, 12337-51, 12455; or its nutritive quality, 12330. A limit of 24 Reichert-Wollny would affect about 30 per cent. of average Russian winter butter, and about 15 to 20 per cent. of the butter produced all the year round, 12106, 12127-8; depending on the season, 12106; and temperature, 12106, 12473-4. There is a great fluctuation in the Reichert-Wollny No. of Russian butter, 12327; and it is greater in Siberian butter, 12212-3. Of the winter butter only 4 per cent. gives a Reichert-Wollny figure below 23, 12309. Butter below 23 Reichert-Wollny produced under favourable conditions, 12316-8. Genuine butter should be regarded as genuine butter, 12329, 12421-2, 12508. The milk analogy is different, 12330-7. There is no Government milk standard in Russia, but there are local standards, 12449.

The difficulties relating to warm stabling and calving throughout the year in Siberia, 12310; will probably be overcome, 12313-5; and the quality of milk will be improved by the proposed introduction of, 12453; the system of purchasing milk according to the amount of butter-fat, 12446-55; but a 24 Reichert-Wollny standard at present would be premature, 12427-30.

The butter industry in Russia and in Siberia: its *locale*, 12092-3, 12196-201, 12204-5, 12224-8, 12283; and development, 12094, 12107-10, 12203, 12216-8, 12273-86. State assistance, 12094, 12246-7, 12272, 12446-8. Exports, 12195, 12199-200, 12206-7, 12214-5, 12278-9. Local consumption of butter, 12194, 12219-21; cheese, 12221, 12252-3; and milk, 12222-3.

Except as regards melted butter, 12490-3; the adulteration of butter is not practised in Russia, 12178; because it does not pay, 12113, 12121, 12142; and the margarine trade is small, 12113, 12119-20; and under control, 12114, 12257-65. The production of suet and lard, 12178-9. The Russian Margarine Law, 12114, 12117-8, 12256-66. A private society, 12266-8; and State laboratories, 12268-9; for the prevention of adulteration. Margarine is not earmarked, 12115, 12434-5; but the Russian Government would probably join in an international agreement on the subject, 12116. Prosecutions of Russian butter in England, 12485-8; prejudicial effect, 12505-8; four cases unsuccessful, 12483; one case withdrawn pending an official standard, 12503-4.

Methods of dairying in Russia and Siberia: The "farms," 12281; the cattle, 12132-3, 12202-11, 12249-51; the quality and yield of milk, 12158-67, 12174-8; of butter, 12168-78. System of feeding, 12134, 12147-9, 12167, 12302, 12438-42, 12497-9; of calving, 12124-6, 12298-306. Butter factories, 12097-100, 12129-39, 12290, 12443-55; pasteurisation, 12188-93. Cost of butter production, 12140-2, 12254-5; market price, 12107-12, 12287-9, 12509; transit, 12143-5, 12219, 12352-8. About 25 per cent. of the butter is made during the winter, 12436. English and Danish butter merchants in Siberia, 12359-64.

The effect of the period of lactation, 12124-6, 12291-308; feeding, 12148-57, 12236, 12241, 12293; stabling, 12239-41, 12248, 12293, 12399; climate, 12152-7, 12237-8, 12473-4; of "keeping," 12183-7, 12291, 12389-90; and refrigeration, 12241. The uniformity of butter and its causes, 12291-7.

The official analysis of pure, 12095, 12181-2, 12459; Russian butter made for this Committee, 12103; the collection, 12095; and history, 12096, 12102; of the samples. The method of analysis, 12101, 12368, 12400-2. The various tables supplied (see Appendix XXXII.), 12367-82. Table I. (A), with 42 samples below 24 Reichert-Wollny, 12394-8; and (B), with 3 samples below 24 Reichert-Wollny, 12374-93; showing the effect of keeping cows outside during the cold and autumnal months, 12399. Supplementary Table I. contains the results shown in Table I., with additional information, tabulated by districts, 12374-80, 12397, 12465. Table II., and its summary (Table III.), 12402-11, 12456-66, 12475; 18 per cent. of the samples below 24 Reichert-Wollny, 12464. Table IV., 12412-7. Table VII., 12467-74, shows 30 samples out of 140 below 24 Reichert Wollny, 12471. This butter was made in European Russia under much better conditions than generally obtain in Siberia, 12472; where, however, the butter was much richer in 1902 as regards the Reichert Wollny figure, 12473-4. Table VIII. shows that of 77 samples of Siberian butter only fell two below 24 Reichert-Wollny, 12418-24. Table IX. also shows 75 out of 77 samples of Siberian butter not at less than 24 Reichert-Wollny, 12425-6.

Professor A. MUNTZ. (81)

Representative of the French Government, 12510-1, 12542.

It is not possible to make regulations regarding the "washing" of butter, or the expulsion of butter-milk; but a standard for water in butter is advisable, 12513; 17 per cent. would be too high, 12514-6. There is no standard for water in butter in France, but prosecutions take place for an excess above 17 per cent., 12625.

A minimal chemical limit for butter is desirable, 12520, 12536; based on the glycerides of the volatile acids, 12517-21, 12537-8; because they are the most important indicators of adulteration, 12522. He suggests 22 to 23 Reichert Wollny as a fair limit in order to include all cases of pure butter, 12539-43, 12570, 12612; or 24 Reichert Wollny, if merely a presumption is raised at this figure, 12578, 12612. The Reichert Wollny method is generally sufficient alone, but in doubtful cases the Koettstorfer number, and the co-efficient of solubility in absolute alcohol, are advisable as corroborative tests, 12579-80.

No legal chemical limit for butter exists in France, but there is an official method of analysis, 12529-31, 12533, 12567-9; which is preferable to, 12621; but corresponds very closely with the Reichert Wollny method, 12553-6, 12570. Butter containing a quantity of butyric acid corresponding to a lower figure than 25 Reichert Wollny is regarded as adulterated, 12534; but prosecutions for adulteration depend upon the discretion of the analyst, 12532; or when the sample indicates 22 Reichert Wollny, 12534-5, 12542-3, 12614, 12622. The procedure, 12543-6, 12613-7, 12628. A little latitude is allowed for Dutch butter, 12618-20. The proportion of French butter below 24 Reichert Wollny, 12571-3. The lowest amount which he has found (once or twice) in French butter was a little over 23 Reichert Wollny (4·6 per cent. butyric acid), 12555-7, 12600-2. Butter adulteration in France, 12548-52, 12618, 12628. The trade in margarine, 12581-3.

The composition of butter-fat, 12517-23. The volatile acids in Normandy butter vary from 5·5 to 6·5 per cent., 12525, 12528; and the average is about 5 per cent. for French butter generally, 12526-8. The quantity of volatile acids in butter influences its quality, 12558-9; and commercial value, 12560, 12565-6, 12603-9, 12620. The influence of exterior conditions on the volatile acids, 12561-4, 12595-7; *e.g.*, cold weather, 12561; food, 12564, 12574-7, 12606; stabling, 12575; the period of lactation, 12590-1; the system of "blending," 12592-4; and of ripening the cream, 12610-1. The influence of geological formations, 12626. State aid, 12584-5; and the methods of dairying, 12586-94, 12627; in France. Gilt-edge Normandy butter, 12603-4, 12623-4. The flavour and aroma of butter, 12592-3, 12604-11.

MINUTES OF EVIDENCE

TAKEN BEFORE THE

DEPARTMENTAL COMMITTEE

ON

BUTTER REGULATIONS.

FIFTEENTH DAY.

MEETING HELD AT

ST. STEPHEN'S HOUSE, WESTMINSTER.

Tuesday, 28th January, 1902.

PRESENT:

The Right Hon. HORACE CURZON PLUNKETT (*Chairman*).

Professor T. E. THORPE, C.B., LL.D., F.R.S.
Major P. G. CRAIGIE.
Mr. CHRISTOPHER DUNN, J.P.
Mr. PATRICK HICKEY.
Professor J. M. THOMSON, LL.D., F.R.S.

Mr. A. E. BALLEINE, *Secretary.*

Mr. HENRY DROOP RICHMOND, F.I.C., called; and Examined.

Mr. H. D. Richmond.

28 Jan. 1902.

8865. (*Chairman.*) I understand you are a Fellow of the Institute of Chemistry, and a late member of the Council of the Society of Public Analysts?—Yes.

8866. You are also connected with the Aylesbury Dairy Company?—Yes; I am analyst to the Aylesbury Dairy Company.

8867. Are you not the author of some works on the Chemistry of Dairying?—Yes; I am the author of "Dairy Chemistry."

8868. How did you come to be practically interested in the question of butter analysis; was it on behalf of the Aylesbury Dairy Company, or was it through independent research work?—I was interested in the subject before I became analyst to the Aylesbury Dairy Company, and I had carried on one or two researches into the composition of butter previous to that; but, of course, my chief interest in it for the last ten years has been in connection with the work of the Aylesbury Dairy Company.

8869. (*Professor Thorpe.*) I think it would be convenient if at this stage you would kindly tell us, as shortly as you are able, what is the chemical nature of butter fat?—Butter is a mixture of complex glycerides; by complex glycerides I mean those in which one molecule of glyceryl is combined with three molecules of fatty acids. It is probable that a large number of them consist of the type in which there is a low fatty acid of the series $C\ H_{2n+1}$ COOH; a high fatty acid of the same series; and a fatty acid of the series $C_n H_{2n-1}$. COOH.

8870. In other words, you mean that the glycerides, or some of them, instead of being combinations of glyceryl with three molecules of one and the same acid are combinations of glyceryl with molecules of different acids?—Yes, that is what I meant to express.

8871. These complex glycerides are mixtures or combinations of glyceryl with fatty acids of the same series as well as with fatty acids of another series?—Yes.

8872. You mean by that, with fatty acids either of the oleic series or of the acetic series?—That is so.

8873. What is the evidence that such is the nature of butter-fat?—The evidence is, first of all, because it has been found that a large number of fatty acids exist in butter-fat. The fatty acids of the acetic series include butyric, caproic, caprylic, capric, myristic, palmitic, and stearic; and then there are also the fatty acids of the oleic series. It has been found that by treatment with alcohol, so as to dissolve a portion of the butter-fat the undissolved portion and the dissolved portion are qualitatively of the same composition, that is to say that the portion dissolved contains the same fatty acids as the portion undissolved, though the quantities are not the same; if, for instance, the fat consisted of a mixture of the simple glycerides it would be found that the portion dissolved in alcohol would consist wholly, or almost wholly, of the glycerides of the lower fatty acids, and that the portion undissolved would consist almost wholly of the glycerides of the higher fatty acids.

8874. Are there any fatty acids which serve to characterise butter as distinguished from other animal fats?—Yes, the lower fatty acids of the acetic series, especially butyric acid and caproic acid.

8875. Those are the acids which are specially characteristic of butter?—Yes.

8876. What are the characteristics of these acids?—They are soluble in water, and volatile when their solutions are distilled.

8877. Then may we take it from you, speaking generally, that butter-fat is distinguished from other animal fats by the circumstance that certain of its acids are readily volatile either alone or in steam, and that they are also readily soluble in water?—Yes.

8878. Have you anything to tell us as to, roughly speaking, the relative distribution of the fatty acids that you have mentioned in butter; are some of them present in large quantities, and others in relatively small quantities, or are they uniformly distributed?—There is a very considerable variation in quantity. The soluble and volatile fatty acids, that is the butyric and the caproic acids are on the average 15·8 molecules out of every 100 molecules of total fatty acids; the oleic acids constitute 36·6 out of every 100 molecules.

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* Continued from the Interim Report.

Mr. H. D. Richmond.

28 Jan. 1902.

and the remainder, 47·6, consist of the higher acids of the acetic series.

8879. Out of every 100 molecules of acids, you say that 15 are volatile; therefore the remainder, 85, are not volatile?—Eighty-five out of every 100 are non-volatile, or practically non-volatile.

8880. Even in a current of steam?—Yes.

8881. Then 15 are both volatile and soluble, and 85 are both non-volatile and insoluble in water?—Yes.

8882. You have given the Committee these numbers in molecular proportions; what do they correspond to in absolute weight?—The butyric acid and the caproic acid will constitute 6·4 per cent. of the total fat.

8883. Not of the total fatty acids?—That is not the percentage of the total fatty acids; 6·4 per cent. of the total fat would be about 6·7 of the total fatty acids.

8884. If 6·7 per cent. of the total fatty acids are volatile and soluble, then the remainder, namely 93·3 per cent., are non-volatile and insoluble?—Yes.

8885. Have you given attention to the nature of the fats which are used to adulterate butter?—Yes. Practically all the fats that are used to adulterate butter consist of glycerides, containing palmitic, stearic, and oleic acids, that is to say, acids which are all insoluble in water, and which are not volatile with steam.

8886. Then what are called the foreign fats are characterised by the absence of butyric acid and caproic acid?—That is so.

8887. Is there any considerable quantity of stearic acid in butter?—The quantity is extremely small in butter.

8888. How much, do you think?—On the average it is about 2 per cent.

8889. Is stearic acid present to any large extent in the foreign fats?—Yes; it consists of, roughly speaking, a quantity which may reach one half.

8890. That is 50 per cent. of the foreign fatty acids are stearic acid or stearin, do you mean?—It would come to the same thing practically whether we take 50 per cent. of fat as stearin, or 50 per cent. of the fatty acids as stearic acid.

8891. Very nearly so, but, perhaps, we had better confine ourselves to the fatty acids?—I will say then 50 per cent. of the fatty acids in foreign fats are sometimes stearic acid.

8892. Why do you qualify it by the expression, "sometimes"?—The reason I used the word "sometimes," is because the foreign fats which are used can be divided into two classes—the one, which includes tallow and beef fat, containing much stearic acid, and the other would include cotton-seed and earth-nut oils.

8893. But these latter are vegetable oils?—Yes.

8894. May we say that the foreign fats of animal origin are characterised by containing relatively large quantities of stearic acid?—Yes.

8895. Even up to the extent of half their weight?—Yes.

8896. Whereas the admixed vegetable oils which may be used may contain stearic acid, but in smaller quantities?—Yes.

8897. What other characteristic difference would there be between the foreign fats of animal origin and the foreign fats of vegetable origin?—The foreign fats of animal origin contain comparatively small quantities of oleic acid, and the foreign fats of vegetable origin contain comparatively large quantities of oleic acid and often acids of a series which is more unsaturated than oleic acid.

8898. Are those unsaturated acids found in butter?—The acids of the oleic series are, but the others which are found in vegetable acids are, as far as is known, not found in butter.

8899. There are certain of these unsaturated fatty acids or acids of the oleic series which are characteristic of vegetable oils, but those which are characteristic of vegetable oils are not found in butter?—That is so.

8900. You have told the Committee that there are two characteristic differences between animal fats, that is to say, on the one hand the animal fat of butter and on the other the animal fats which we may call foreign fats, which are used to adulterate butter; and that those characteristic differences are, that whereas butter-fat contains relatively large quantities of butyric acid it contains small quantities of stearic acid—not more than 2 per cent.; while the animal fats which may be used to adulterate butter contain relatively large quantities of stearic acid up to the extent of 50 per cent., and practically no butyric acid?—That is so.

8901. Vegetable oils, however, are occasionally used, you tell the Committee, to a small extent only, I presume, in adulterating butter, or are they used to a large extent?—I think they are used to a large extent—that is to say, I think that the majority of adulterated samples at the present time contain vegetable oils. Of course the quantity of vegetable oil which can be added is not very large because it is liquid and requires some fat of a high melting-point to make the consistency of the adulterated article approximate to that of genuine butter-fat.

8902. What you wish us to believe, then, is that, although vegetable oils are constantly used, the amount which is used in any given sample of butter is comparatively small?—Yes.

8903. Would you kindly tell the Committee what are the chief vegetable oils which are used to add to spurious butter?—The chief vegetable oils are cotton-seed oil, which is used in the cheaper qualities of margarine, and earth-nut oil and sesame oil, which are used in the higher qualities of margarine, and sometimes cocoa-nut oil.

8904. There are four, then, which are used; are they used always in the same way?—I think earth-nut oil, sesame oil, and cotton-seed oil are never directly added to butter, but are always added through the medium of margarine; is that not so?—That is so; they are always mixed with some fat of a higher melting point—for instance, beef-fat.

8905. They are never added direct, but they are always added in the form of oleomargarine?—Yes.

8906. Is cocoa-nut oil added in the same way?—No; cocoa-nut oil is sometimes mixed in without the addition of other fats or oils.

8907. What is the object of the addition of cocoa-nut oil?—I think the chief object of the addition of cocoa-nut oil is because it approximates in its composition more to genuine butter than other adulterants.

8908. (*Chairman.*) Has it a higher melting-point than the others?—Yes; its melting-point is somewhere about the same as butter-fat.

8909. (*Professor Thorpe.*) And it also has about the same amount of volatile acids as butter, has it not?—It has not the same amount, but it has an appreciable quantity of volatile acids. I think the object of its use is on account of its approximating in composition to genuine butter, and therefore it is not so easy to detect.

8910. Those vegetable oils, however, can be distinguished by chemical tests directly applicable to them, can they not?—There are certain tests which vegetable oils give. Cotton-seed oil, for instance, will give a characteristic reaction by heating with silver nitrate, either in a solution of alcohol or a mixture of alcohol and ether, or a mixture of alcohol and ether with fusel oil added. Sesame oil gives a reaction either with sugar and hydrochloric acid or with furfurol and hydrochloric acid.

8911. Their recognition, then, by the chemist does not present any particular difficulty, or does it?—There are certain difficulties in the way, because it has been found that if the cows have been fed with large quantities of cotton-cake the characteristic reaction passes into the butter, although it is nothing like as strong as that obtained from the oil itself.

8912. Is that equally true of sesame oil?—It holds to a certain extent with sesame oil, but the quantities of sesame cake which have to be given to the cows in order to produce the characteristic reaction of sesame oil is extremely large, and with small quantities of sesame cake the reaction is not found.

8913. Now take the other oil, earth-nut oil; has that any characteristic reaction by which a chemist can discover its presence?—Yes; earth-nut oil contains a fatty acid which is not found in any of the other oils—namely, arachidic acid. It belongs to the same series as stearic acid, but is higher in the series.

8914. Do you lead the Committee to believe that it is possible to discover this acid in the ordinary process of testing so as to identify earth-nut oil?—In the case of butter it would be extremely difficult to do.

8915. Now as to cocoa-nut oil; what are the characteristics by which one could ascertain the presence of that oil when it is used as an adulterant?—Cocoa-nut oil contains a very small quantity of oleic acid, and it contains a fair quantity of soluble acids, a comparatively small quantity of which are distilled over when an aqueous solution of them is heated. It can be distinguished in butter with a fair amount of ease, and I think accuracy, by estimating on the one hand the fatty acids which are insoluble and on the other hand the fatty acids which are volatile; and by means of the ratio between those one can see whether the butter is a genuine one or has been admixed with cocoa-nut oil.

8916. Would you describe to the Committee as shortly as you are able what are the principles of the methods by which the presence of these adulterants can be recognised in butter?—The processes may be chiefly divided into two classes. The first of them is based on the fact that butter contains soluble and volatile fatty acids, while, with the exception of cocoa-nut oil, the adulterants are practically free from those. The other process is based on the fact that the quantity of acids of the oleic series is usually less than the quantity of such acids in the fats used for admixture.

8917. Those being the principles, can you tell the Committee how those principles are made use of?—Perhaps it would be convenient if I describe each of the various methods which are used. The first method I would take, because it is the oldest, is that of Hehner. That consists in saponifying the fat by means of caustic alkali (which splits it up into glycerin and the sodium salts of the fatty acids); then adding a strong acid such as hydrochloric acid, that splits up the sodium salts into the fatty acids themselves and sodium chloride; then the fatty acids are washed with hot water, which dissolves out the soluble acids and leaves the insoluble acids, which are then collected and weighed, the soluble acids being contained in the filtrate. By this method both the insoluble acids and the soluble acids can be estimated.

8918. Is Hehner's method still in use?—It is used, I think, largely, but I do not think it is used as much as it was, because it takes rather a long time, and a good many of the other methods in use now can be done in a shorter time.

8919. Would it be safe for an analyst to draw any inference as to the character of butter from the determination of the insoluble acids alone by Hehner's process?—I think not, because the method has certain defects which are inherent in it. The first is that it is not very easy to completely wash all the soluble fatty acids out of the insoluble fatty acids; the second is that the fatty acids have to be dried, and during the process of drying they undergo certain chemical changes.

8920. What is the amount of the insoluble fatty acid which is usually obtained from butter by Hehner's method?—The average percentage that I have obtained is 87·75 per cent., the variations having been from 85·6 to 89·6.

8921. Are those extreme variations what other chemists have found, or what you yourself only have found?—Those are the variations that I have found myself; in some cases other chemists have found higher figures.

8922. You mean wider variations?—I was referring to variations in one direction when I said higher figures. I think that the variations have been wider in each direction, but it is more particularly in the high direction that I would wish to speak.

8923. I do not quite understand. You tell us that your personal experience is that the amount of insoluble acids obtained by Hehner's process ranges between 85·6 and 89·6; over what number of analyses have you obtained those figures?—Those figures are obtained from 99 samples.

8924. Are those samples of English butters or of butters of any origin?—They are of butters of any origin.

8925. Then they may be Continental butters?—Yes.

8926. And they may have been obtained at any season of the year?—Precisely.

8927. Does your personal experience agree with what other chemists have found?—Other chemists have found wider variations. I cannot say exactly what the lower figures are, because I have not paid a great deal of attention to those; but I know chemists have found higher figures.

8928. Independently of that, do you know anything more?—Yes, I have some figures which were obtained by my predecessor at the Aylesbury Dairy—Dr. Vieth. He has found samples over 90 per cent.; in fact, there was one sample which went up as high as 92 per cent.

8929. Was that an English butter?—Yes, that was.

8930. Was there anything otherwise abnormal in that butter?—It was obtained from a cow which had been in milk an extraordinarily long time—I forget the exact time, but I think about 18 months.

8931. Was it recognised before that sample was analysed that it was an abnormal butter; was there anything to lead to the suspicion that it would yield a very high insoluble acid number?—Yes, the volatile acids were low.

8932. The volatile acids are the complement of the insoluble ones, and therefore if those are high the others must be low?—Yes, it was expected to yield abnormal results because the cow had been in milk so long, and it was an experience which Dr. Vieth had then obtained that cows which had been a long time in milk yielded abnormal figures.

8933. Was that butter a commercially valuable butter?—No, it was an experimental sample.

8934. Was it one of the Aylesbury Dairy Company's samples?—Yes.

8935. Was it what they were selling?—No, it was not; the quantity was extremely small, and it was obtained for experimental purposes.

8936. These high numbers you say are liable to be affected by the cause to which you have already drawn attention, namely, the difficulty of getting rid of the last traces of the soluble acids?—Yes.

8937. You think that possibly some of these high numbers are vitiated from that circumstance?—Yes, it is possible that they are.

8938. Would there be any sources of error affecting the low numbers on the other side?—Yes, it is possible there might be a certain amount of loss of fatty acids mechanically. Perhaps I would make that simpler if I were to explain exactly how it is done. The fatty acids after the sodium compounds have been decomposed by a strong acid, come to the surface of the solution and after heating for some little time they form a clear layer on the top. The solution with the fatty acid is then poured on to a filter paper, and it is washed on the filter paper with hot water. It is conceivable that if the washing is not very carefully done small quantities of the fatty acids which are in the liquid state may be washed over the side of the filter paper, or if there is an extremely small hole in it portions may also pass through.

8939. But those are little manipulative difficulties which of course are in the nature of accidents?—Yes.

8940. They are not inherent in the process?—No, they are not. There is also another thing which might cause the fatty acids to be low; that is, the chemical changes which take place in drying them. These chemical changes consist of two things; one is the absorption of oxygen which leads to an increase of weight, and the other is a loss of the elements of water forming anhydrides, and by the formation of anhydrides decrease of weight might take place, and that would lead to the results being low.

8941. You have explained to us the principle of Hehner's method, and the limitations within which it is, you think, accurate; would you kindly go on to the next method?—The estimation of the soluble fatty acids would be the next method I would take. It is a portion of Hehner's method, that is to say, it is usually done at the same time, and with the same portion of fat. In Hehner's method the insoluble fatty acids are weighed, the soluble fatty acids are washed out, and those are estimated in the filtrate. The way those are estimated in Hehner's method is, instead of adding simply an unknown quantity of hydrochloric acid, an exact quantity is added which will a little more than neutralise the quantity of alkali which was used for saponification. The quantity of alkali which is added is known, the quantity of acid which is added is known, the quantity of acid that the alkali will combine with is known, and so there is a certain small excess of the acid which is added and which is also known. When the total acid in the filtrate is estimated, it is found that there is a larger quantity of acid there than the known excess of hydrochloric acid; the difference between the known excess, and the total quantity is an index of the soluble fatty acid which is present.

8942. It is obvious from what you have told us then, that any loss in washing out the soluble acids from the insoluble cake falls upon the determination of the soluble acids?—Yes, that would be so.

Mr. H. D. Richmond.

28 Jan. 1902.

8943. Therefore to the extent that the determination of the insoluble acids is imperfect, the determination of the soluble acids is to the same extent imperfect, and for the same cause?—It is not quite correct to say "to the same extent," because the fatty acids are estimated in the filtrate not as the fatty acids which they really are, but they are all calculated to butyric acid. The fatty acids which are hard to wash out are not butyric acid, but some of the others, and as one part of butyric acid corresponds to perhaps 1½ or even two parts of the actual acids which are left behind, to that degree then it is not quite correct to say that the two estimations are affected to the same extent.

8944. I think we have disposed of the determination of the insoluble and soluble acids; now will you go to the next method?—The next method I will take will be the determination of the volatile acids. The method which is in use is called the Reichert method, and the particular modification is the one which is due to Wollny, and the method therefore is usually spoken of as the Reichert-Wollny method. This method is performed by taking 5 grammes of the fat, saponifying that with 2 cubic centimetres of a 50 per cent. solution of caustic soda, and 10 cubic centimetres of strong alcohol, heating for half an hour, and then distilling off the alcohol, adding 100 cubic centimetres of water which is boiling, and has been boiling for at least a quarter of an hour, and 40 cubic centimetres of sulphuric acid of such strength that it more than neutralises the caustic soda which is added. The whole solution is heated until the fatty acids have formed a clear layer on the surface, and then 110 cubic centimetres are distilled in from 28 to 32 minutes. I would also say that the form of apparatus has been prescribed. Of this 110 cubic centimetres which are distilled 100 cubic centimetres are taken and titrated with 1-10th normal alkali using phenolphthalein as indicator; the figure thus obtained is increased by 1-10th to bring it up to the 110 cubic centimetres, and this figure is returned as the Reichert-Wollny figure.

8945. Have you anything to tell us critically of the character of this method?—The conditions under which this method has been performed have been so strictly laid down that it seems to me to be the most accurate method that we have, and the one which is most suitable for forming the basis of a standard.

8946. (*Chairman.*) By whom were the conditions laid down?—The conditions were first of all laid down by Wollny, and the same conditions, with one or two small modifications which add to the exactness of the method, were laid down by a committee which consisted of Professor Thorpe and several members of the Society of Public Analysts. This method which has been laid down by them has been adopted by the Society of Public Analysts.

8947. (*Professor Thorpe.*) Speaking from your own experience, have you made many estimations of the Reichert-Wollny number in butters?—Yes, I have made a large number of them.

8948. Would you tell the Committee within what limits the Reichert-Wollny number varies?—My own experience has been that on the average it gives 28·4 cubic centimetres, and the variation that I have observed has been between 21·2 cubic centimetres and 35 cubic centimetres.

8949. Are those variations in what you know to be genuine butters?—Yes, in genuine samples.

8950. From how many samples did you obtain your average; in other words, what is the numerical basis of that average?—Between 600 and 700 samples.

8951. Have those extended over all periods of the year?—Yes.

8952. Are they only English butters, or are they Continental butter also?—They are English and Continental butters.

8953. Would they also include Colonial butters?—No, in those figures I have not included Colonial butters

8954. Can you indicate to the Committee what proportion of the 600 or 700 are English butters, and what proportion Continental butters?—I think, roughly speaking, about one-third are English and two-thirds Continental.

8955. By English, do you mean British, or do you strictly mean English?—I mean English only.

8956 (*Major Craigie.*) Not Irish, for instance?—I have not included Irish. I had a small number of Irish which I did not include with the English butters.

8957. (*Professor Thorpe.*) We gather that you are inclined to recommend the Reichert-Wollny process rather as a standard process if a standard process should be adopted at all; you think that if any method is to be adopted that may be suggested as the basis of the standard?—Yes.

8958. Have you anything more to tell us about the Reichert-Wollny process in view of that recommendation?—There is one thing I would like to say about it. It practically gives the same estimation as the soluble fatty acids, though the two things are not exactly comparable. First of all the soluble fatty acids are estimated as a whole, and the Reichert-Wollny figure is only estimated partially. Secondly, the Reichert-Wollny process gives figures which are far more exact and concordant than the estimation of the soluble fatty acids.

8959. What you mean is that two analysts working perfectly independently would be much more likely to obtain perfectly concordant results in the case of the Reichert-Wollny than they would be in the case of the determination of the soluble acids?—Yes.

8960. Therefore two determinations made by the same analyst in the Reichert-Wollny process would be much more likely to lead to concordant results than two determinations made by the same analyst of the soluble acids?—Yes, that is so.

8961. (*Chairman.*) When you talk of the soluble and volatile acids, you are really speaking of the same thing, are you not, except that by one process you simply liquefy it, and by the other process you volatilise it?—Yes, that is so; the two terms, soluble and volatile, are practically interchangeable, because the soluble fatty acids of butter are volatile. When I talk of soluble fatty acids it means that I have simply dissolved them out in water; when I call them volatile acids I mean that beyond doing that I have heated the solution and distilled over the acids.

8962. You are not differentiating between two constituents, but simply between two methods of determination?—Yes, between two methods for the determination of the same constituents.

8963. (*Professor Thorpe.*) Have you anything more to bring to the Committee in support of your view that the Reichert-Wollny method may be considered as the basis of a standard method?—The only thing is, I think that practically it is accepted as a standard method throughout the world.

8964. In what sense is it accepted as a standard method? Do you mean that any other Government has laid it down as a standard method?—What I mean by its being accepted as a standard method is that if analysts among themselves are talking of butter, that is the method that they would use in the first instance to express their results. Perhaps I might amplify that by saying that when analysts talk of abnormal samples they almost invariably mean samples in which the Reichert-Wollny figure has fallen below a certain limit.

8965. They define abnormality from the point of view of the Reichert-Wollny determination?—That is practically so.

8966. What other methods are available for chemists on which to base inferences as to the character of butter?—There is the potash absorption or saponification method. That method consists in taking a known quantity of fat, heating it with a measured volume of the standard solution of alcoholic caustic alkali until it is completely saponified, and then estimating the excess of alkali which is left. By that means an index of the alkali necessary for the total saponification of the fat is obtained. That method differentiates to a certain extent between butter-fat and the fats that are used for admixture, because the foreign fats, with the exception of cocoanut oil, take less alkali for saponification than butter-fat. The chief objection to that in my mind lies in the fact that the difference between butter-fat and the foreign fats on the average is only 13 per cent. of the total alkali required for saponification of the butter-fat, and as each of the two classes of fats—the genuine fats on the one hand and the fats used for adulterating on the other—show variations among themselves, the margin is reduced to a comparatively small amount.

8967. Then your point is that the numbers are not sufficiently distinctive?—Yes.

8968. What is the name of this process?—Koettstorfer.

Mr. H. D. Richmond.

28 Jan. 1902.

8969. Is that process much used by chemists?—Yes, it is a process which is largely employed; it is an extremely useful process, I may add, if it is taken in conjunction with some of the other determinations, although by itself it is in my opinion not sufficiently reliable.

8970. Its value is merely as a confirmatory process then?—It is a little more perhaps than a confirmatory method, because if one determines the potash absorption, the soluble fatty acids and the insoluble fatty acids, then from those three one can calculate certain figures which are of use; for instance, the mean combining number of the insoluble fatty acids can be calculated from that.

8971. Your point is that, taken in conjunction with the Hehner process as you have described it to us, the Koettstorfer process is valuable?—Yes.

8972. And that to some extent these are dependent?—Yes.

8973. What are the limits of variation in the Koettstorfer numbers?—I have found on the average 22·58 per cent. of potash required for saponification, and the limits have been 22·01 to 22·98.

8974. On how many analyses are these numbers based?—I have not got the exact number down, but it is more than 20 and under 100—I am afraid I cannot give it more exactly than that.

8975. Are those English butters?—Those are English and Continental butters.

8976. It is quite obvious that you do not attach very much importance to the Koettstorfer method if you confine yourself to comparatively few analyses. Would you proceed to the next method?—The next method I would mention would be the determination of the density. It is a method which is fairly satisfactory, because it is capable of very accurate determination, but it suffers from the same objection as the Koettstorfer method—that is to say, the variations in butter and margarine approach one another rather much. The average figure that I have found at 37·8 degrees centigrade—that is 100 degrees Fahrenheit—has been 0·9117.

8977. On how many determinations do you base that?—The number there I also have not got, but the number is about the same as for the determination of the potash absorption; the variations are from 0·9105 to 0·9122. I might add that other observers have found variations a good deal wider than mine.

8978. What is the variation as regards margarine?—The variation is about from 0·901 to 0·903.

8979. Then, roughly speaking, the densities are in the ratio of 90 to 91, 90 being margarine and 91 being butter?—Yes.

8980. Now the next?—The next method I would take would be the estimation of the iodine absorption. The chief value of that lies in the fact that it is independent of the property which is taken advantage of in most of the other methods—that is to say, in the Reichert-Wollny method, the Koettstorfer method and the Hehner method, namely, the presence of butyric acid, and that it depends wholly on the quantity of oleic acid which may be present. The average iodine absorption I have found in butter has been 37·4 per cent., the variations being from 31·6 to 42 per cent; whereas the iodine absorption of margarine varies from 50 to 60 per cent. The objection to its use is that the variations of both butter and margarine are wide compared with the difference between the two.

8981. The degree of iodine absorption, or the extent of iodine absorption, we may say, is a direct measure of the oleic acid?—Yes.

8982. Does that exhaust what you have to tell us in respect of it?—Yes. There is only one other method which I need mention, and that is the determination of the refractive index. That is a method which is largely used, because it is extremely easy, and can be done in a very short space of time. I have found that the refractive index goes with the iodine absorption to a very large extent, and it probably depends chiefly on the same property as the iodine absorption.

8983. That is on the oleic acid?—Yes.

8984. In other words, on the olein which is present?—Yes.

8985. (*Chairman.*) Does it not also go with the Reichert-Wollny figure?—It goes with that to some extent, because the iodine absorption and the Reichert-Wollny go together to some extent, but I have found in those cases where the Reichert-Wollny and the refraction have not gone together, that the iodine absorption and the refraction still have gone together.

8986. (*Professor Thorpe.*) You rather led us to believe that the factor in butter which determined the refractive index is the olein?—Yes.

8987. When you speak of the refractive index, do you mean the absolute number, which we call the refractive index, or do you mean an empirical number, such as that afforded by the Zeiss instrument?—It is usually determined in butter analysis as an empirical number afforded by the Zeiss instrument. Of course, that is not the true refractive index, and it is usually spoken of as the refraction figure.

8988. You are talking of it in that sense?—Yes, I am speaking of the refractive index in that sense.

8989. You mean you do not directly determine the refractive index?—No.

8990. That, then, covers the ground of the methods of analysis which are applicable to the examination of butter, with a view to getting some evidence of its genuineness, does it not?—Yes.

8991. Perhaps you had better tell the Committee how these various factors are affected by the changing conditions under which the cow may legitimately be placed?—Do you wish me to discuss the whole of them, or can I confine myself to the Reichert-Wollny figure?

8992. We will begin with the Reichert-Wollny figures. I may have something to ask you about the others as we go on, but just take your own course?—The Reichert-Wollny figure is affected by at least two influences; the first being the state of lactation; that is to say, the time since calving. Directly after calving the Reichert-Wollny figure is extremely low, but almost immediately it rises very considerably, till it becomes a normal figure. This normal figure without much variation persists until towards the end of lactation; that is to say, until about eight or nine months after calving. Then the Reichert-Wollny figure begins to fall. The other chief influence which affects the Reichert-Wollny figure is the influence of cold. It has been shown that when cows are exposed to severe cold the Reichert-Wollny figure has a tendency to fall. There is a third cause which also affects the Reichert-Wollny figure; that is, the character of the food which is given to the cow. When cows are fed exclusively on grass the Reichert-Wollny figure is usually high; but when a good deal of artificial food—especially cotton-cake and other oil cakes—is given, the Reichert-Wollny figure tends to fall. Then there is a fourth influence; that is, the influence of the breed. This I have only noticed myself with regard to Jersey cows. The Reichert-Wollny figure from butter yielded by a Jersey cow is almost always higher than that from butter yielded by, for instance, Shorthorn cows.

8993. Does the age of the cow affect the Reichert-Wollny number?—I am afraid I have not any experience of that, that I remember, but I think not.

8994. Have you said all you wish to say as to the influence of environment and of different conditions on the Reichert-Wollny number?—There is one thing I would like to point out. I have here some figures showing the Reichert-Wollny number in samples taken in each month of the year. I find that the samples with a low Reichert-Wollny figure tend to accumulate in the latter part of the year.

8995. In the late autumn, or in the winter—which do you mean?—With regard to English butter, it is in the autumn, and with regard to Continental butter, it is in the winter.

8996. By the phrase "tend to accumulate," I gather you mean that you find a larger number of butters with low Reichert-Wollny figures at these particular periods of the year?—Yes.

8997. Have you collated the iodine values with these changing conditions, because they affect, of course, the volatile acids?—Yes.

8998. You are telling us now what circumstances affect the proportion of those acids which are characteristic of butter—namely, volatile acids?—Yes.

8999. But there is one acid which is not volatile, but which is very variable in amount—namely, the oleic acid. Have you any information as to how the changing conditions of the cow's existence affect the proportion of oleic acid?—Yes, I have found in a large number of

Mr. H. D. Richmond.

8 Jan. 1902.

cases that where the Reichert-Wollny figure has been low the iodine absorption has been high. Up till a comparatively short time ago I had been under the impression that that was a rule which one could take as being fairly true; but comparatively lately I have met with samples which have had a low Reichert-Wollny figure, and have had a comparatively low iodine absorption as well.

9000. What I want to gather is this: What happens in the metabolism of the cow? Where do the acids go? How do they change? Is it the fact that when we get low volatile acids, we get a high non-volatile acid of the same series; or is the loss of butyric acid and caproic acid to be accounted for by an increased amount of, we will say, palmitic acid, and myristic acid, or by an increased amount of oleic acid—an acid of another series?—It does not always appear to follow the same course. My experience with butters prepared in England has shown that when the butyric and caproic acids have been deficent the oleic acid has been in excess.

9001. In other words, your experience is that the oleic acid is increased as the volatile acids are deficient?—Yes.

9002. Not that the non-volatile acids of the same series—as the butyric acid—increase?—In talking of English butters alone, that is my experience. But comparatively lately there has been a large quantity of butter obtained from Siberia which has come into England; in those samples, which I have examined, I have found that a low Reichert-Wollny figure is accompanied by a somewhat low iodine absorption; that is to say, the depression of the butyric acid and caproic acid is due to an excess of palmitic acid and myristic acids, rather than to an excess of oleic acid.

9003. In the case of the Dutch cows, which, I understand, show this peculiarity of a low Reichert-Wollny number during the late autumn, what is the effect there on the oleic acid?—The oleic acid is high in those.

9004. In other words the acids, which under normal conditions will go to butyric acid, or the substance, whatever it be, which under normal conditions will go to butyric acid and caproic acid, under those conditions tend rather to go to oleic acid than to the higher fatty acids; is that so?—Yes. I would like to hand in the figures which I have mentioned in evidence and the figures on which I have based the statement as to the variation of the Reichert-Wollny number with the seasons. (*Appendix* XXI.).

9005. (*Chairman.*) I understand that on the whole you consider the Reichert-Wollny figure the best method of determination that can be applied under existing circumstances?—Yes.

9006. What figure would you take as the standard?—I would take the Reichert-Wollny figure of 25 cubic centimetres.

9007. Could this figure be safely adopted without inflicting any considerable hardship upon honest traders?—I would suggest that in order to inflict the smallest amount of hardship possible, at least a year's notice should be given before it came into force in order that producers may have time to make arrangements which would be most favourable to the production of butter of normal composition.

9008. Can producers very materially affect the question except by ceasing to adulterate?—I think so. I have mentioned, in answer to Professor Thorpe, the causes which in my opinion tend to produce low Reichert-Wollny figures, the two most important being the period of lactation and a low temperature. Instead of causing all cows to calve at about the same season of the year, it is possible to have half the herd to calve at one season and half at another season, for instance in the spring and in the autumn. I would say that that is not a suggestion which is entirely impracticable, because English farmers have adopted that method of late years to a large extent. The second thing which a farmer could do would be to bring his cows in a little earlier before the cold weather commenced. The chief time in the 24 hours when a cow is exposed to cold is at night, and if the farmers could arrange to house their cows at night a little earlier than is done at the present time, I believe that the very large number of low Reichert-Wollny figures which are found in cold countries would be avoided.

9009. You no doubt recognise the difficulty which this Committee will feel in making any recommendation which will necessitate a change in the conduct of farming in order to comply with the law, but I presume that you feel strongly that a lower figure could not be adopted without inflicting a greater hardship upon honest makers of butter?—Yes, I feel that. If a standard is adopted which is appreciably lower than the one which I have recommended, I believe it will increase the facilities for the admixture of margarine with butter, and that then the honest producer will be subjected to a severe competition, and I think the harm which would be done by that competition would be greater than the harm which would be done by fixing such a standard as I have recommended. I would say especially that the recommendation that the mode of farming should be changed is based on the fact that English farmers have changed their method of farming of late years to comply to a certain extent with the requirements that they should produce a high quality of milk, and I think if the English farmer has done that there is no reason why the farmer abroad should not also do the same.

9010. (*Professor Thorpe.*) Would not the effect of a limit of 25 be to knock out of competition a very large quantity of what otherwise is good butter, namely, Siberian butter?—Yes, I think it would, and for that reason I suggest that at least a year's notice should be given.

9011. But the conditions under which Siberian butters are produced, of course, are not comparable with the conditions as regards mildness of climate, and so on, under which butters can be produced in these islands for example; therefore what might be properly applicable to us would scarcely be applicable in the case of Siberia, would it?—It would not be wholly applicable, but I do not think even there that there would be a very great difficulty. My reason for thinking so lies from what I have heard in conversation from a representative of the Russian Board of Agriculture, who was over here some time ago. He told me that if a standard of 25 cubic centimetres was fixed, they would have to keep the butters which fell below that at home, and they would have to study the conditions by which they could raise the quality of their butter, as far as the Reichert-Wollny figure was concerned, so that I think even there it is not anticipated that the fixing of a standard, say, of 25 would lead to any very great hardship.

9012. Referring to the phrase you used, namely, the quality of butter as denoted by the Reichert-Wollny figure, do you mean to imply that there is any necessary connection between the quality—that is, the commercial value—of butter and the Reichert-Wollny figure?—No, there is not; the connection is not at all a necessary one.

9013. Inasmuch as it is a practical commercial fact that butters of relatively high quality come in with relatively low Reichert-Wollny numbers, are you not seeking to impose upon the merchant, by the adoption of a particular limit under the Reichert-Wollny method, a condition which, as a merchant, he would say, "I cannot fulfil, and I do not see why I should fulfil"?—Unfortunately, also a large number of butters of low commercial quality, and of the same Reichert-Wollny figures, come in, and that low commercial quality is obtained by the admixture of other fats; and, although it would be a hardship, on the one hand, on the producer if genuine butters that have a low Reichert-Wollny figure were stopped, it would also be a hardship on the public and on the honest traders to have the competition of adulteration.

9014. I recognise the Scylla and I know the Charybdis, but still the point is, by the infliction or imposition of a perfectly arbitrary number like this, how can you expect merchants to interfere with a supply of an article which already meets a public demand on the ground of its high commercial value?—I think we have had a certain amount of experience of a fixed standard in the case of milk. In order to comply with that fixed standard I am told that certain changes are being made by English farmers, and I do not know that any great hardship has been inflicted by that, but I do know that it has had an excellent result, and that it has already raised the quality of milk as far as my experience goes.

9015. But the analogy is not perfect, is it?—It is not quite perfect.

9016. In the case of milk you were directly raising the quality; you were demanding a higher quality of the milk, but now you are not demanding a higher quality of butter by the imposition of the Reichert-Wollny number?—That is so.

9017. In the case of the milk, the commercial value of the milk depends, of course, upon its fat?—Yes.

9018. Therefore we asked, and we have got a somewhat higher quantity of fat; but now you are asking that in addition to that higher quantity of fat which has been brought about by these operations there should be something fixed as to the nature of that fat, namely, that it shall have a relatively large quantity of butyric acid?—Yes.

9019. (*Chairman.*) Are you satisfied with that recommendation, or do you regard it as the best makeshift possible in the existing state of our knowledge?—I am not at all satisfied with it, if it is considered as an absolute means of distinguishing between genuine butter and adulterated butter. It is a makeshift, but I think it is the best makeshift we have, and the one which will inflict the least amount of hardship.

9020. Do you think that analytical research has kept pace, if I may say so, with adulteration in the matter of butter?—No, I think adulteration always keeps a little ahead.

9021. Have you any suggestion as to the encouragement of research in order that analysts might be induced to at any rate make a good race with the adulterators?—I would point out that practically all the research in butter is left to individual analysts, and these are often men who hold positions which take up a good deal of their time, and so the time which they can devote to research is comparatively small. Also I would point out that research in butter analysis is attended with a certain amount of expense, which has to be borne by these men. I would suggest that if the Government could see their way to set aside a certain sum annually for research into the composition of butter and its variations, and the means of distinguishing between genuine and adulterated butter, it would be well repaid by the results which would be obtained.

9022. Have any foreign Governments adopted this course?—I am told that the Danish Government offered a prize some years ago, but I do not know whether any of them have devoted a sum annually to research. There is one form of research which is subsidised by foreign Governments, but which is not subsidised by the British Government; that is the establishment of agricultural experiment stations. In almost every country but our own there are a large number of these stations, and butter analysis would fall under the scope of their work, though I am afraid it is not given a very important place.

9023. (*Professor Thorpe.*) Is it not the fact that Denmark does indirectly spend a considerable amount of money in laboratory work in connection with its butter industry, and so indirectly does accumulate experimental data?—I do not know whether money is furnished by the Government for that purpose directly.

9024. The control station, for example, of which Professor Stein is the head, is a Government institution, is it not?—I believe so, but I have not any exact information of that.

9025. (*Mr. Hickey.*) Are you a public analyst?—No, I am not.

9026. Have all the analyses that you have been making in butter to ascertain its chemical composition been confined to English and Continental butters?—The whole of those that I have brought before the Committee have. I have examined other butters—Irish, Australian, and Colonial, but the number has not been very large.

9027. Is 25 the Reichert-Wollny number that public analysts will pass as genuine butter at the present time?—They would certainly, I think, pass all samples having 25, and above that, as genuine samples.

9028. Would they pass 24?—I think the practice varies largely with individual public analysts. There is no standard which is agreed upon generally, and each man takes his own figures.

9029. Do you know that if a limit of 25 were set up it would exclude about 50 per cent. of all the Dutch butters imported into England?—I have heard so, but I have not observed any facts myself which would allow me to say that the statement is correct.

9030. Can you tell the Committee what proportion of Danish butter your limit of 25 would exclude from the market?—No, I am afraid I have not sufficient figures. I have the figures of the Danish and Swedish butters together, and of those about 12 per cent. of my samples have fallen below.

9031. About what proportion of English made butter would your limit of 25 exclude?—Of my samples it comes to about 8 per cent. I would like to mention that the number of samples in the series which I have handed in, which have fallen below 25, is larger in proportion to the number of samples which are above 25, because it has been my practice, wherever I have found a sample falling below, to obtain further samples from the same source, so I have to some extent searched for a low sample. If the figures have been above 25 I have not made any special search for samples of the same Reichert-Wollny figure.

Mr. R. D. Richmond.

28 Jan. 1902.

9032. In the case of the English samples was the butter made under the control of the Aylesbury Dairy Company?—With one or two exceptions it was.

9033. Would the conditions under which their butter was made be more favourable than those which would obtain in England amongst farmers generally?—I think that on the whole they would be a little less favourable.

9034. Why?—Because the cows which supply the Aylesbury Dairy Company have a rather larger proportion of artificial food, for instance, cotton cake, than is general, and in my experience feeding with cotton cake is one of the factors which tend to depress the Reichert-Wollny figure.

9035. Is not cotton cake used freely in Denmark and Sweden in the winter?—Yes, I believe so.

9036. Do you find that the Reichert-Wollny figure is lower in the winter than it is in the summer?—Yes.

9037. You say that there is about 12 per cent. of all the Danish and Swedish samples which have fallen below that figure of 25; would you call that a large proportion of the total make of Danish and Swedish butter?—When it is considered, as I have explained, that I have searched for those low samples, and when it is also considered that they take place chiefly towards the end of the year, I do not think it is a very large proportion.

9038. Is it your experience that French and Italian butters contain a higher Reichert-Wollny figure than those of any other country?—Yes, it is, I think.

9039. What is the reason of that; is it due to climatic conditions?—I think it is partly that; it is partly also due to the fact that there is not so much artificial food given to the cows; it is chiefly pasture.

9040. Is the proportion of butter made in England large as a commercial article?—I am afraid I cannot give you any exact figures, but I can say that the proportion of butter made in England is less than the proportion of that made abroad; what the actual ratios are I do not know.

9041. (*Mr. Dunn.*) In the present state of scientific knowledge are you in favour of setting up a standard at all?—I think I am practically forced in that way. We have the alternative on the one hand of having no standard, which means that a very large number of adulterated samples must be passed, or, on the other hand, we must fix an arbitrary standard. Therefore I think we have no option but to fix a standard.

9042. Although you are not quite satisfied with the standard, and although you think it is a makeshift?—I think it is a makeshift; I quite see that it does not do what would be highly desirable—namely, distinguish sharply between genuine samples and adulterated samples.

9043. But you think it is better than nothing?—I do.

9044. I think you said also that you thought public money might be applied with advantage to the gaining of more knowledge on the subject?—Yes.

9045. Would you recommend that it should be given in the shape of an annual grant or in the shape of a prize?—I think it should be given in the shape of an annual grant. I think the prize system is not very satisfactory, because it excludes a certain number of men who have to earn their own living, and whose time is practically all taken up in doing so, from doing any work for it.

9046. You stated that the standard might affect the conditions of production so as to suit this arbitrary and scientific standard without at the same time improving the commercial value of the article—that is, the Reichert-Wollny number might be complied with by the farmer taking a great deal of pains, and avoiding certain conditions, although in doing so he would not improve the quality of his butter; do you not think that the producers would object to being forced to troublesome methods which would not improve the value of their product, but which would merely make

Mr. H. D. Richmond.

28 Jan. 1902.

it fall into line with an arbitrary scientific standard?—I think it is highly probable that producers will offer some objection, but I think, on the other hand, that the adoption of a higher standard will improve the commercial value of butter—that is to say, it will bring up the price of butter. It will do that in two ways. First of all, it will exclude a certain amount of butter from the market, and will stop the competition of adulterated butters; and the supply being less, the price will rise. Then also it will cost a certain sum to the producers to comply with the conditions, and they will want to see a return for that.

9047. You have said that you think something might be done by having a portion of the herd calve at one period of the year and another portion of the herd calve at another; but sometimes the herd consists of one cow. What would you do then?—I think the problem would be enormously simplified if all herds consisted of one cow, because then if a man was summoned for adulterating his butter he could fall back on the cow, have samples taken from that one cow, and prove that his cow was giving butter of the same quality as that for which he was prosecuted.

Dr. K. H. M. van der Zande and Dr. J. J. L. van Rijn (accompanied by Mr. H. S. J. Maas, Consul-General for the Netherlands), called; and Examined.

Dr. K. H. M. van der Zande and Dr. J. J. L. van Rijn.

9048. (*Chairman.*) I understand that you appear here on behalf of the Government of the Netherlands?—(*Dr. van der Zande.*) We do.

9049. I believe that you are director of the Government Agricultural Experiment Station at Hoorn, and that your colleague, Dr. van Rijn, is director of the Government Agricultural Experiment Station at Maastricht?—That is so.

9050. Were you sent over by a Department of the Government?—Yes.

9051. By what Department?—By the Department of Public Works, but there is a separate Board of Agriculture connected with it. (*Consul-General.*) It is the Department of Public Works, Trade and Industry, and in that Ministry there is one special department entirely devoted to agriculture.

9052. Have you received instructions from any Chambers of Commerce, as we call them, or other public bodies, besides the State Department?—(*Dr. van der Zande.*) No; we have only received instructions from the Department of Agriculture.

9053. I think you are opposed to the fixing of a standard?—We are.

9054. You consider that butter is an article for which in the present state of chemical knowledge no standard such as has been suggested can be properly fixed?—We do.

9055. Would you give your reasons for that?—The reason is that butter is a natural product with a very varying composition. You can have a butter that is quite genuine, and which will yield a very low number if tested for the volatile acids, and you can also have a butter that is quite genuine, with a very high number. If you are fixing a standard which is based upon the average, it is therefore quite possible that you might analyse a butter which is quite genuine, and find it yield a figure which would be under your standard. That is the principal reason for our opposition.

9056. Supposing that the Reichert-Wollny number of 25 were fixed, would that act injuriously towards a large part of the butter that you are interested in?—Yes. In some years it might injure a large quantity of butter; in other years it might injure a smaller quantity, but there can be no question that if a standard of 25 were fixed, there would always be many genuine Dutch butters which would be presumed to be adulterated.

9057. Does that answer apply to butters from all parts of the Netherlands, or only to butter coming from certain districts?—So far as we know there is a difference in the butters. In some parts of our country you will find more butters with a low Reichert-Wollny figure than in other parts of the country. I think we can say that especially in those parts of our country where the cows are always on the meadows the danger is a little greater than in the other parts of the country. We have some reasons for saying, therefore, that any one standard would not be equally dangerous for all the districts in our country.

9058. Has not a Reichert-Wollny number been fixed in Belgium? Yes, there is a regulation, I think, that butter which has a Reichert-Wollny number of less than 25 should be considered as an abnormal butter. For the volatile acids 25 is the limit in Belgium.

9059. Do you, speaking on behalf of your Government, say that if such a limit were fixed in England it would destroy the import butter trade from the Netherlands?—It would occasion many difficulties; in some years it would cause a great deal of difficulty at some seasons of the year, especially in the province that exports a great deal of butter to England—Friesland—as there the numbers are often below 25.

9060. It would be a serious detriment to the farmers in that country?—I think so.

9061. What percentage of the total product of butter in the Netherlands is exported to this country?—I could not say, for I do not know.

9062. Have you no idea at all?—No.

9063. Could it be as much as a quarter of the total produce of Dutch butter?—Perhaps so, but I could not say.

9064. Have you no knowledge at all—I will not say of how much the percentage is—but how many hundredweights or how many tons it would be?—No, I have no idea.

9065. Have you in your Department any statistics of the total production of butter in the Netherlands?—Yes, I think so.

9066. But you have not the figures with you?—No.

9067. Perhaps you could get them for us?—Yes.

9068. (*Major Craigie.*) Perhaps you have the number of cows in milk in Holland?—We have, but not here. (*Consul-General.*) I believe your Board of Agriculture receives the official reports on agriculture in the Netherlands. Those reports contain all these figures. These gentlemen have come here without being prepared to give evidence on the trade.

9069. If we know the number of cows we can make an estimate of the total produce of the cows, how much is sold as milk, and how much is sold as butter; and then we can tell how much of the butter comes here from our own figures?—Yes, of course. I think you will find in the official reports to which I have referred the exact quantity of butter that is produced in the factories.

9070. I think that point was touched upon, was it not, in a Commission of Inquiry that was held in Holland some years ago?—(*Dr. van der Zande.*) No. Each year there is published a report of agriculture, and you will find many of these figures you are asking for in those reports. Of course, those reports do not say exactly how much butter comes from so many cows, but you can get an idea upon that point from the reports.

9071. (*Chairman.*) Would it not be possible for the Dutch farmers to take precautions to secure a higher Reichert-Wollny number if they were duly warned, and if they had time to change their methods?—It is not quite certain that they could. There are some points that give an idea that something in that direction can be done perhaps, but it is not yet proved, and one cannot say that it is always possible to do it. The farmers, especially in Friesland, are merely tenant farmers, and they must take care that their farms yield them an income. The Friesland meadows in the latter part of the year sometimes yield a great deal of grass, and if they were then to stable the cows all that grass would be wasted, therefore the farmers let the cows stay out, because with them, of course, the pecuniary question is necessarily the principal one. Another thing is that it has not been exactly proved that bringing the cows in will always yield the desired result. Speaking generally, I think it is not always possible to take measures which shall secure that the Reichert-Wollny number does not fall below any given limit.

9072. Are you opposed to the fixing of any number as a limit?—Yes, in general, that is our position.

9073. On what grounds?—Because, in the first place, butter very often may be under a certain limit, and yet it may be genuine and pure butter.

9074. That is an argument, is it not, against fixing the limit too high; but it is not an argument against fixing any limit at all?—That is so; but what is the number that can always be reached by butter? That is not known, and you cannot say that a genuine butter never falls below a given number; therefore you cannot say what number should be the limit. One inference may be that butter should not fall below the number 25; another inference may be that it should not fall below the number 23; and in the Table which we have sent in we have given you a great many instances of genuine butters to illustrate this. (*Appendix XXII.*)

9075. Can you not as a chemist put some limit below which no fairly well made genuine butter could fall?—As a chemist I cannot.

9076. You could fix no limit at all?—No.

9077. Could you not fix a limit below which the butters which had to be protected would form such exceptional cases that they would hardly be worth considering?—I could not name any number in that direction.

9078. Do you see this difficulty—that if a limit were fixed low enough to protect these exceptional butters there would be a tendency to adulterate good butters down to the limit?—Yes, but that is a danger in the case of all limits.

9079. Not in the case of a high limit?—Yes, unless you put the limit so high that there is scarcely any butter in the country that could reach it; but with any limit that you could reasonably take it would be impossible to say that there is no butter above it.

9080. Would you not agree with me that if you put the limit, say, at 20, there would be a great temptation to adulterate butter having a figure of 25 down to the 20?—Yes; as I have remarked, that is the danger of all limits.

9081. What measures would you suggest in order to protect the farmer against the dishonest adulterator of butter?—I do not suppose that there is a chemical measure that could do it. I think measures of another kind should be adopted.

9082. What other kinds would you suggest?—It is a practical matter, not a chemical matter.

9083. I understand you to say that you can make no suggestion on a chemical basis?—I do not think so at this moment. But, of course, chemical investigation and invention may alter matters.

9084. But you are of opinion, are you not, that the object we have in view may be attained?—It may be asked whether other means might not be more efficacious against adulteration of butter than standard cyphers. This object may be attained by exercising a control of butter making by means of which the buyer can be guaranteed against fraud. A short time ago this system was introduced to a certain extent into the Netherlands by some agricultural societies, or confederacies of butter makers, notably in the provinces of Friesland, South Holland, North Brabant, and Limburg. As may be gathered from communications in English trade periodicals, the measure has been favourably received by the English trade, and doubtless the English Government will fully share in this sentiment.

9085. You have sent in a description of the scheme which has been published by the Institute of Control of the Friesland Board of Agriculture; can you state to us what its rules are?—Yes, they are as follows:—"(1) The absolute purity of the butter produced in the establishments of those makers who submit themselves voluntarily to the jurisdiction of the said Board of Agriculture will be guaranteed by the Board, and that such guarantee will be a full and reliable one is demonstrated by the rules to be enacted, and which are as under. (2) The sworn inspectors of the Board shall have admission at all times, either during the day or night, to the factories of the members of the institute. (3) A thorough inspection of the premises of the members will be made by such inspectors at irregular intervals and without previous notice. (4) Samples will be taken of the milk, cream, and the butter at the factories themselves, and also of the butter packed and ready for or on the road for export. (5) Analyses of these samples will be made at the laboratory of the Board of Agriculture by a sworn official, Doctor in Chemistry. (6) The results of such analyses will be recorded, and also any difference between the composition of the butter found at the particular factory with that of the butter of the same factory ready for or in transit. (7) The manufacturers who submit themselves to the control of the institute shall be bound in penalties varying from £100 to £1,000 (in the discretion of the Board) on any of them being convicted of mixing margarine or any other foreign substance with their butter." I may mention that 28 factories had joined the Institute by the 1st of May, 1901, and that their average annual output was 59,000 cwt. (*Appendix XXIII.*)

Dr. K. H. M. van der Zande and Dr. J. J. L. van Rijn.

28 Jan. 1902.

9086. This institute appears to be established not by Government regulation but by voluntary understanding between a certain number of farmers?—(*Consul-General.*) It is not an official Board in the sense that the English word might imply. (*Dr. van der Zande.*) It is protected, I may say, by the provincial Government of Friesland.

9087. Has it any statutory power?—No. I think not.

9088. It is a purely voluntary association then?—Yes.

9089. Does it not simply amount to this, that it is an institute for putting a trade brand, which has got a certain reputation, upon the butter as it is sent over to the markets here?—No, it has not a brand yet.

9090. (*Professor Thorpe.*) There is absolutely no method then of identifying this butter when it comes over to this side?—Not yet.

9091. Will you kindly explain to this Committee, for this is what we really want to get at, how you propose to link up the butter which comes under your control and supervision in Friesland with the butter which is received into the Port of London?—I think there are means.

9092. But how are you going to connect your system of control with the butter that we get on this side?—I think marks could be adopted, and we could prove that the butter was controlled by that Institute, and so you would have what you would like to have.

9093. But you have not done that, and this machinery has not yet been established?—No, it has not yet.

9094. (*Chairman.*) You are making a suggestion for voluntary action which in your opinion would be as efficient as State control?—Yes, it can become so. It is only a short time ago that the system was introduced, and it is only in the experimental stage. If it can be proved that this system would be adopted in England, or if the authorities here would say, "It would be a good system if you would take some measures to prove that all your butter is controlled by that Institute"; then I think the system would spread farther. If it has any effect in increasing the import into England, I think there would be no question about that.

9095. (*Professor Thorpe.*) What you are actually doing now is you are making a purely tentative suggestion of something which possibly may lead to something or another if our Government and your Government chose to act upon the lines you have suggested, and you put that forward in this tentative way to take the place of any system founded upon chemical analysis?—As a representative I could not say that at this moment, as we have no instructions to say that. It is only my personal suggestion that that can be done.

9096. But I understand you are representing the Government, and that you are stating to us the official view?—I think it is also the meaning of our Government.

9097. (*Chairman.*) Has this "synopsis" been before your Government?—Yes.

9098. (*Professor Thorpe.*) Do you mean that this suggestion which is put forward in the synopsis of your evidence has been the subject of debate in your Parliament?—No, not in the Parliament.

9099. Then it has not been brought to the knowledge of your Parliament?—No, only to the Department.

9100. To a department of the central Government or of the provincial Government only?—To the Department of Agriculture of the central Government; this is from the Department of Agriculture of the central Government.

Dr. K. H. M. van der Zande and Dr. J. J. L. van Rijn.

28 Jan. 1902.

9101. Are you authorised from the central Government to make the suggestion that you can institute for the whole of Holland a system of control?—No, I cannot say that.

9102. All you can say is that a certain number of farmers in Friesland have voluntarily banded themselves together to subject themselves to control?—Yes.

9103. What proportion of the farmers of Friesland have entered into this voluntary association?—I think you can see it in one of the documents we have sent to the Committee which contains a list of the analyses of butter controlled by it.

9104. What is the exact proportion of farmers who are subject to this control compared with the total number of farmers who make butter?—We have here only the report of the Friesland Institute of Control; we have got an Institute of Control in South Holland, but I have not got their numbers here.

9105. The point of my question is this: What proportion of the butter-makers in Friesland have come under this control organisation?—I think it is not a large proportion as yet, but, as I have said, it is still in the experimental stage.

9106. Have 10 per cent. come under the control?—I could not say so exactly.

9107. What is the average amount of butter made in Friesland per year?—I cannot say.

9108. Have you no idea?—No. Will you allow me to remark that we come here specially as chemists, and this is not a chemical question.

9109. But I thought you represented the official departmental view?—Only in regard to the chemical side of the proposal to fix standards.

9110. (*Chairman.*) When was this Institute of Control organised?—A year ago, I think.

9111. What was its object—was it to improve the quality of butter or simply to guarantee its genuineness?—To guarantee its genuineness.

9112. Then its object was a trade object—in order to market the butter to better advantage in this country chiefly?—Yes, I think so, and to introduce the butter under its own name as genuine Friesland butter, so that there could not be any question but that the butter controlled by the Institute was genuine. That was the object—not to improve the quality.

9113. I understand that your Government would object strongly to a Reichert-Wollny number of 25 being adopted?—They would object to any number at all being adopted.

9114. Therefore they would object to 25 being adopted?—Yes.

9115. Would you not admit that if a lower number were adopted that would lead to adulteration?—I think the opposition would be quite as large.

9116. You object to a low number on the ground that it would lead to adulteration, and you give that as a reason against fixing a low number?—Yes, but if you will allow me there is also this point to be considered: If you fix the standard at 25 or 20 or 22—whatever you will—then it will not follow that any butter lower than your standard would necessarily be a butter of lower quality. That is a question of great importance here, I think.

9117. (*Professor Thorpe.*) What is the point that you wish to make now?—The point is that although butter may have a Reichert-Wollny number of 25, or 22, or only 20, that number of itself would not give any indication as to the quality of the butter.

9118. (*Chairman.*) Your point is that the butter with a low number may be commercially just as valuable as butter with a high number?—Yes, or it might be more valuable.

9119. (*Professor Thorpe.*) Does anybody ever say that there is any connection between the quality of butter and the Reichert-Wollny number?—I can prove to you that there is no connection at all.

9120. Has anybody ever said there was?—No; but I think it is a point that is of great importance here, because if you adopt a standard or limit the public might presume that any butter under that standard would be of lower quality than a butter of a higher standard, but that would not be true. Of milk you can say that, but not of butter.

9121. And nobody has said it?—That is all right.

9122. (*Mr. Dunn.*) As I understand you say that the producer of the butter would be put to unreasonable inconvenience by the adoption of the Reichert-Wollny number, and that while he was put to that unreasonable inconvenience his English buyer would not be in any way benefited by the regulation?—Yes.

9123. Are you satisfied with the other measures which you say would produce the desired result, and do you think that they could be worked out satisfactorily?—Yes, I think so.

9124. (*Professor Thorpe.*) Of course you have read this book on "The Composition of Dutch Butter," which the Committee has had presented to it by Dr. van Rijn?—Yes.

9125. Dr. van Rijn has made a number of observations on Dutch butter taken at various times of the year, and he has given us the analytical details of his observations in the second half of the book; he has also given us certain conclusions on pages 21, 22, and 23. Of course, Dr. van Rijn and not you is answerable for the analytical work in the book, because you have not made those analyses, I understand?—No.

9126. Assuming that his determinations are accurate, do you agree with the conclusions which Dr. van Rijn deduces from them?—I could not say at the moment that I agree with all the conclusions. Are you referring particularly to page 22?

9127. Yes, where he claims that he has "established for a certainty that the abnormal chemical composition of Dutch butter during the autumn must be attributed to the circumstance that the farmers leave their cattle in the meadows until late in the year." Do you agree with that?—I agree up to a certain point, but there are other reasons also operating.

9128. Do you agree with that conclusion?—Yes, generally. It states that that is one of the causes to which that abnormal composition must be attributed; that is all right, and that also is my view.

9129. I wanted to be quite clear; is there any distinction between you and Dr. van Rijn in the generality of your conclusion? Dr. van Rijn comes to the conclusion that the real reason for the low Reichert-Wollny number is the fact that the cattle are left in the meadows until late in the year, and he states that conclusion without any qualification; do you agree with that or not?—No, not absolutely. It must be attributed to the whole of the circumstances; in general it is so, but that is not the only reason.

9130. But what he says is that it is the only reason?—That is not my opinion.

9131. You say there are other circumstances which will give a low Reichert-Wollny number than the mere keeping of cattle out into the late autumn?—Perhaps so; there may be.

9132. Now what are they?—We do not know; we should make experiments in that direction.

9133. You do not know, then, that there are such circumstances; you only think there may be?—I say that we do not exactly know all these influences. There are influences at work which we do not know even yet. This year especially we are making experiments to ascertain whether there are other influences, and how large those influences are, and what would be the effect of stabling only, and of stabling combined with better feeding, and so on. We do not know what questions may arise.

9134. I gather that your answer is this—that whilst the late pasturage of the cows is at least one, and presumably an important, factor in lowering the Reichert-Wollny number, there may be also, you think, other circumstances?—Yes.

9135. But what they are you do not know?—Of course there are some that are known; for instance, there is the question of the calving of the cows.

9136. You mean the influence of lactation?—Yes.

9137. What other influences may be at work?—There is the feeding.

9138. What else?—The individual character of the cows.

9139. Do you mean the idiosyncracy of the cow; the particular qualities of the individual cow, or the particular kind of breed?—The particular qualities of the individual cow.

9140. As regards the individual cow, let us consider for the moment what that is; do you think that is at all traceable in the resultant product? Is not butter, as commercially made, a mixture of the fat of a large number of cows?—In general, yes.

9141. Therefore the influence of any abnormality in the individual tends rather to disappear in the general result, does it not?—It is decreased very much by it, but we have also butter that is imported into England from farms that have only perhaps 20 cows or so.

9142. The chance that the 20 cows shall all of them be in that abnormal condition of idiosyncracy is rather remote, is it not?—Not wholly; we do not know how large the influence is.

9143. Therefore of course you desire to have further experiments upon that?—Yes.

9144. Up to the present you have no reason for saying that these things occur, and you have no experimental facts to show what the influence is?—Not yet. We are just making experiments, and we have got some of the results, but they are not yet ready, they will be ready in perhaps two months or so.

9145. I suppose you in Holland are not the only people who make experiments on the influence of various conditions on cows?—No.

9146. Other nations have made experiments very much of the same order?—Yes.

9147. We have a large amount of experimental work, have we not, on the influence of lactation, feeding, exposure, and all the other influences?—Not a great deal, but there is some; there is Dr. Schrodt's work, but that is only one experiment.

9148. Collectively there is a good deal of information on this question; the influence of lactation, for example, has been studied by more than one person, has it not?—I think these experiments have all this mistake—that they have not distinguished between the several influences. That is the great defect which these experiments often have. You really have several influences working together, and you ought to separate them exactly if possible. It is not always possible to do so, but so far as it is possible you should distinguish between the several influences, and that is what I think most of the experiments have not done.

9149. I will take you on a single point, the influence of lactation. Are you aware of Professor Nilson's work, which is now some years old, on the influence of lactation?—Is he a Professor in Denmark?*

9150. Professor Nilson is a Swedish chemist, or rather was, because he is dead?—I do not remember for the moment.

9151. You know of Professor Nilson as a chemist—you have heard of him?—Yes.

9152. He has the reputation of being a man of high character as a scientific man, has he not?—Yes.

9153. And he is likely, I suppose, to make experiments in a scientific way—you would imagine that, would you not, from Nilson's character and position?—Yes.

9154. Do you remember what Nilson's position was with respect to agricultural experimental work?—I cannot say for the moment.

9155. Do you say that you are not familiar with his work?—I do not remember it for the moment.

9156. You are, I understand, the head of the Agricultural Station at Hoorn, are you not?—Yes.

9157. Are you actually the Director of it, or the Chemist?—I am the Director.

9158. You take personal direction of the Chemical Laboratory?—Yes.

9159. You are by profession, as you have told us, a chemist?—Yes.

9160. You are Director of Hoorn by virtue of being a chemist?—Yes.

9161. And a chemist who has paid special attention to the chemistry of agriculture?—Yes, of course.

9162. The table that you have sent to us contains the results of something like 650 determinations of the Reichert-Wollny numbers at Hoorn on Frisian factory butter during the year from the 17th October, 1900, to the 4th of September, 1901?—That is butter from the Frisian co-operative factories.

9163. Does Friesland extend on both sides of the Zuyder Zee?—No.

Dr. H. K. M van der Zande and Dr. J. J. L. van Rijn.

28 Jan. 1902.

9164. Is there not East and West Friesland?—No. Friesland is only on the east side of the Zuyder Zee.

9165. I thought you had a portion of Friesland at one time on the other side?—It is named West Friesland, but it does not belong to the province of Friesland.

9166. Anyhow, these butters have reference to East Friesland?—They are Friesland butters.

9167. You are speaking of the Friesland, which extends, we will say, from the Zuyder Zee to the frontier?—No, only to Groningen.

9168. And from the north to where—to Drenthe?—From the north to Overyssel.

9169. These analyses are fairly representative of the product of the whole of that province, are they?—Yes, I think so.

9170. There are some 650 analyses, in round numbers. Of these 650 analyses I find that only 21 give numbers below 25—that is, somewhere about 3 per cent.—and of those which give numbers below 25, 14 are above 24. I think the Committee would like to know, assuming that those are valid numbers (and the total number is sufficiently large for us to be quite sure that they are fairly representative), where is the actual hardship upon Frisian butter in the imposition of a Reichert-Wollny limit of 24 or 25?—I think you have given the answer yourself—that it would injuriously affect 3 per cent. of all this butter; and that is throughout the whole of the year, not only in the months of September, October, and November. If 3 per cent. is injured, I think that is sufficient.

9171. If 3 per cent. throughout the whole year was affected, you would think that would be a hardship?—Yes.

9172. You have pointed out, and properly pointed out, that the whole of those low numbers are concentrated within a particular time of the year?—Yes.

9173. They are all of them on this table concentrated between the 17th October and the end of the following November—that is to say, they were obtained from samples collected between the 17th October and the 27th October, and between the 12th November and the 28th November—the whole of the 21 are accumulated in that period. It appears therefore, as you say in the table, that these abnormal numbers are practically concentrated within a month or six weeks of time?—Yes.

9174. During a month or six weeks of time you may thus have butters which occasionally will be below 25, and which sometimes will sink as low as 24, but very rarely will they be below 24; that is what your table shows, is it not?—Yes.

9175. Therefore, even if you complain of 25, a limit of 24 at all events would not do you very much harm?—Perhaps in this year not. That table is based only on the Frisian butter which is exported to England, but there are other parts of the Netherlands which export butter to England. Another point is that this year might be, and I think it has been, somewhat exceptional. The weather has been very good this autumn, and that might have given a somewhat higher figure perhaps. If you take the numbers for 1896 you will have many more below 24 and 25.

9176. You mean, that with a rainy, cold autumn, with, perhaps, a cold summer, when the pasturage has not been luxuriant, you may have a larger number of these abnormal butters?—I think so.

9177. That is exactly the point to which the Chairman addressed himself when he asked you. Is that not a condition of things which, if necessary, your farmers could meet? If the autumn is cold, that is a matter which is obvious to everybody, is it not—to the farmer, as well as to his beasts?—Yes.

9178. What is the economic difficulty beyond, perhaps, putting him to a little extra expense of stabling the cows a little earlier?—That is it—it is more expensive.

9179. But that is a condition of things which we might ask him to meet in the interests of the purity of butter?—Purity?

9180. Yes. Of course, it would not affect that particular butter, but to the extent that we depreciate the Reichert-Wollny number, or to the extent that we do away with it altogether, we deprive ourselves of one criterion of the genuineness of butter. You tell us that it must be done away with, because now and again a Frisian farmer, who keeps his beasts outside in the late autumn, and practically half starves them, cannot conform to this standard, and you ask us in his

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* Dr. Van der Zande added the following note to his proofs: "I understood that Professor Nielsen of Denmark was mentioned here."

Dr. K. H. M. van der Zande and Dr. J. J. L. van Rijn.

28 Jan. 1902.

interest to do away with anything like a chemical control over the purity of butter. That is your point, is it not?—Yes, because there are other questions to be considered—not only the question of keeping the cows out in the autumn. You can also have very low numbers in August, for example. The table deals with butter from Friesland, which has a meadow origin, but take, for instance, Groningen; there, the cows are not generally on the meadows, and they are fed in another way, but we had genuine butters from Groningen factories and creameries on the 1st August, which were under 25.

9181. We should be glad to have those figures: the Committee has not been made aware of them. Perhaps you could send them to us?—Yes, they can be sent.

9182. Anyhow, it appears that in Friesland there are no abnormal butters—that is, butters with low Reichert-Wollny numbers—produced after the 28th November; all the rest of the year, even whilst the cows are in the stables, or whilst they are in the fields during the subsequent spring and summer, the numbers are nowhere near 25, but get up as high as 28, 29, 30, 31, and 32, and they only come so low as I say in late October?—Yes, that is so.

9183. (*Mr. Hickey.*) Have all the experiments that you have made been confined to North Holland butters?—No, to Friesland butters.

9184. Is it a matter of common knowledge in Holland that butter from North Brabant has been suspected to be adulterated for many years?—Yes, there are gentlemen who know something on this point. I have an idea that it is, especially from Brabant, that there might be danger in this direction.

9185. Have you not heard it outside your profession?—Yes, sometimes—not generally, but in special cases.

9186. How long has that suspicion been entertained respecting that particular district in Holland—five or ten years, would you say?—Perhaps longer, because the majority of the margarine factories are probably in Brabant.

9187. Do you know that Dutch margarine manufacturers make butter and ship it to England?—Genuine butter?

9188. Pure butter?—I do not know.

9189. Have you heard that butter is bought at Hertogenbosch and Eindhoven, and after being analysed and found to contain a large proportion of volatile fatty acids, a higher price is paid for it than for ordinary butter for the purpose of adulteration?—Yes.

9190. You have?—Yes.

9191. How long has that been the case?—I heard of it quite a year ago—perhaps last year or the year before—that is to say, I have heard of cases like that.

9192. Are they of frequent occurrence?—No, I think not.

9193. Have you not had some prosecutions lately by your Government against people in Holland preparing butter in that way?—Yes.

9194. Have convictions been obtained against them?—(*Dr. van Rijn.*) The cases against those persons will come before the Courts on the 12th February next—a fortnight from to-morrow.

9195. The cases have not been dismissed by the Courts then?—No, not yet.

9196. (*Professor Thorpe.*) Is it not the fact that butter is sold from Friesland to be taken to Brabant for the purpose of being mixed with margarine, so as to lower its Reichert-Wollny number to a point that will pass?—(*Dr. van der Zande.*) I have heard of such cases.

9197. Is it not the fact that this control system was instituted to prevent that as much as possible?—Yes.

9198. The system was not instituted in the interests directly of English trade, but to prevent the quality of Frisian butter being impaired by the malpractices of other Dutch butter producers?—That may have been a reason, but still it was not the principal reason. Of course, the object is to get a better price for their butter. That is the question. If you can give a guarantee that the butter is really genuine, then you may hope to get a better price. The control system was not instituted in order to give Englishmen a better butter, but to enable the farmers to give a guarantee that their butter was pure, so that Englishmen would pay a better price for it.

9199. (*Chairman.*) What were the circumstances which had raised a doubt about the genuineness of Dutch butter from which doubt this institute of control wanted to protect the commodity?—I do not see anything else but the prosecutions in England and in other countries, also in the Netherlands itself?—(*Consul-General.*) If I understand you aright, your question was, what has led to the presumption that a certain amount of Dutch butter was adulterated at certain times of the year?

9200. Quite right; that is the question?—The answer is, presumably, because prosecutions took place in this country.

(*Dr. van der Zande.*) And not only here, but in other countries, also in the Netherlands itself.

9201. (*Mr. Hickey.*) What steps have the Dutch Government taken to deal with these fraudulent practices in Holland?—The Government has passed a new butter or margarine law for the better control of the butter trade.

9202. Is the new law likely to assist in the suppression of this fraud?—Not sufficiently, I think.

9203. Is it within your knowledge that Dutch butter shipped to England is very much lower in the Reichert-Wollny figure than any other butter imported into England?—I could not say that, but perhaps in general there are more low butters from the Netherlands than from other countries.

9204. (*Professor Thorpe.*) The Committee would be glad to know how far, in your opinion, the general composition of the butter of Friesland corresponds with the general composition of the butter of Holland as a whole; may we take it that Friesland butter is representative of Dutch butter in general?—Not of the butter from all parts of the Netherlands, but I think we can say that it is generally representative of all those parts of the Netherlands where meadow feeding, or what you call grass feeding, is generally adopted—for instance, in Drenthe.

9205. In Drenthe, I suppose, the pasturage is rather worse?—Yes, and the soil is rather different from that in Friesland, so the kinds of grasses are different, and so, perhaps, the feeding.

9206. The meadows of Drenthe are perhaps not so rich as the meadows of Friesland?—Generally speaking, they are not.

9207. You have more moorland, bog, and heather, and heath in Drenthe?—Yes.

9208. Do you think the conditions of pasturage have ever been known to affect the character of the butter which comes from Drenthe?—I do not think so.

9209. You say that there are certain districts in Holland of which the Friesland butter cannot be taken as representative. What parts of Holland are they?—I divide it into two parts. I take the parts of the Netherlands where the general feeding of the cows is on the meadows, and I take the other parts of the Netherlands where the cows are fed on other foods.

9210. This is a mere surmise, I understand, of yours; you think it may be, but you have no experimental evidence to show us that it is?—No, we have not many experiments performed exactly for that purpose.

9210*. (*Major Craigie.*) Are the breeds of cattle the same in Friesland as in the other parts of Holland?—No, the breeds are not the same.

9211. There is, I believe, a considerable and marked difference between the breeds of cattle in Friesland and the breeds in South Holland?—Yes; and in Overyssel and Brabant there are also different breeds of cows.

9212. Is there a great difference between the butter from those different breeds in its general texture and character?—It may be so.

9213. Do you think there is such a difference?—It is possible that there is some difference, but it is only a question of degrees.

9214. Have you any experiments to show the results of the butter made from different breeds of cows in Holland?—No.

9215. At any rate, you have not any printed?—No.

9216. (*Chairman.*) Would you tell the Committee what action is taken by the Netherlands Government for the protection of the purchasers of butter from fraud?—The Netherlands Government has passed the Margarine Act, which we call the Butter Act of 1901. This Margarine Act is only to prevent the adulteration with foreign fats, but then there is the general law under the penal code, which gives protection against adulteration in general, and covers also the adulteration of butter with foreign stuffs—water, and so on. This new Act is especially to deal with the adulteration by foreign fats—that is, fats not coming from milk. I think Mr. Hickey asked me if I thought the Margarine Act of the Netherlands would afford sufficient protection against adulteration, and I said that I thought not. I would like to remark that in saying that I was expressing my personal opinion only. The authorities might, perhaps, take another view of the Act, but that was only my personal opinion.

9217. (*Mr. Hickey.*) Do you think the Act requires strengthening to deal with the adulterating practices in Holland?—I myself personally should think so.

9218. (*Professor Thorpe.*) In what respects is the law of the 1st April, 1901, deficient?—I think I cannot say anything on that point, because we have no instructions upon it. I cannot as a representative, as a delegate, say anything about it.

9219. Do you not care to volunteer a statement in your individual and personal capacity?—No, I would rather not.

9220. (*Major Craigie.*) In the synopsis of your evidence you say that the fear of adulteration resulting from a low standard is not an imaginary matter, because such adulteration has been proved by experience to have occurred in Belgium?—Yes.

9221. Have you any evidence to show what has been done in Belgium; have they fixed a low standard to which the butters had been adulterated down?—In Belgium they have the standard of 25.

9222. And yet a standard of 25 has resulted in adulteration being practised?—Yes.

9223. (*Professor Thorpe.*) What you mean is that certain butters have had their composition lowered to a Reichert-Wollny number of 25?—Yes.

9224. (*Major Craigie.*) They, having naturally a higher number, have been lowered as a matter of adulteration?—Yes; they have their numbers like 33, 32, and 30, and so they are adulterated down to the standard of 25.

9225. (*Chairman.*) Does Dr. van Rijn desire to give any evidence?—(*Dr. van Rijn.*) No, I think not.

9226. (*Professor Thorpe.*) But I should like to ask you about the results that you have been good enough to prepare for us in your book. You say at the top of page 21, it is "firmly established that in those parts where the cows are exposed to a late pasturage, as in Friesland, Groningen, and a few other provinces, the butter made during the autumn is of an abnormal composition. If this conclusion be correct, then we ought to find no abnormal properties in butter made in those parts where pasturage is an exception to the cow." You then quote the cases of the provinces of Limburg and North Brabant, where the cows, "as regards the influences of the weather, are under much more favourable circumstances than the cows in the northern parts of Holland. Hence I have collected 166 samples of butter made in 166 co-operative manufactories in all parts of the above-mentioned two provinces." Those would represent, I presume, the factory butter, which is the produce of a great many cows?—They do, but that quantity is not so large as you usually get in Friesland; in those two provinces they are all very small factories.

9227. That may be, but, nevertheless, the butter would be representative of that which is produced in the provinces of Limburg and North Brabant?—Yes.

9228. At the bottom of page 21 you give the results of your analyses of those 166 samples; in no single instance was the Reichert-Wollny number below 28; five of them ranged from 28 to 28·9, 20 from 29 to 29·9, 70 from 30 to 30·9, and 62 from 31 to 31·9. In other words, therefore, of these 166 samples something like 132 had a Reichert-Wollny number between 30 and 31·9; that is so, is it not?—Yes.

9229. Therefore, at all events, nobody in Limburg and North Brabant need fear anything from the imposition of a Reichert-Wollny number of 25?—I do not think so.

9230. Then why should they fear the imposition of a Reichert-Wollny number as a limit under these circumstances?—They do not fear it, but you must remember that these are the experiments in one year. I do not think there will be any danger to these provinces from fixing the figure at 25, but the quantity of butter made in these provinces in relation to the total quantity made in Holland is comparatively small. These 166 factories only produce in a year 2½ million of kilos of butter, but in Friesland there are, I believe, three or four factories which produce nearly that same quantity.

Dr. K. H. M. van der Zande and Dr. J. J. L. van Rijn.

28 Jan. 1902.

9231. Perhaps you can give the Committee the information that they wanted as to the relative distribution of the butter produced in Holland? Where is the largest quantity of butter produced in Holland?—The largest quantity is produced in Friesland and South Holland.

9232. Are you aware what is the total quantity of butter Holland produces per year?—I do not know.

9233. Can you give us the relative proportion of the butter produced in Friesland, for example, and in South Holland?—No.

9234. I understood from Dr. van der Zande—you will correct me if I am wrong—that the composition of the butter of Friesland might be taken as representative of the composition of the butter of South Holland?—Yes, for the greatest part it could.

9235. That is to say, the numbers he has furnished us with may be taken as fairly representative of the character of Dutch butter in general?—I think so.

9236. North Brabant, you told us, is not representative, but then that is not in consideration, because North Brabant and Limburg are out of the question, and they give a Reichert-Wollny number far and away beyond the number of 25?—Yes, they do.

9237. Therefore we have got something, at all events—that 25 would only occasionally hit even Friesland and South Holland, and it would practically never hit Limburg and North Brabant?—That is so.

9238. The figures that you have given us from Friesland, we understand, may be representative of the greater proportion of the butter of Holland?—Yes.

9239. What other great butter-producing districts in Holland are there?—The other provinces of Groningen, Drenthe, Overyssel, and Guelderland.

9240. Can you give the Committee any ideas of the relative output of butter from these various places?—No.

9241. I do not mean the absolute amount—that you have told us you cannot do—but perhaps you can tell us where does the greatest quantity of butter come from in Holland?—From the northern part—Friesland, Groningen, and Drenthe.

9242. And the composition of the butter from these provinces is represented by the numbers which have been given to us?—Yes.

9243. In your opinion, the question of the early stabling of the cows has a great deal to do with accounting for the occasional low Reichert-Wollny numbers?—Yes.

9244. Do you think that the most important factor of the whole?—The experiments mentioned in my book are the only experiments that I have made, and that is the conclusion that I have come to upon the figures that I have given. But there is not only the stabling to consider, there are other circumstances, such as feeding, also when the cows come into the stable there is a change of food, so that you cannot say that it is only due to the stabling. The result of these investigations is only to tell us that at the moment the cows are stabled the composition of the butter changes—that I can say.

9245. The fact of the cows being stabled means that the cows are kept rather warmer?—Yes.

9246. And that they are given a more plentiful supply of food?—Yes.

9247. In other words, by taking the cows out of the damp cold fields, and by giving them a rather better roof and rather better food, you do naturally get rid of these low Reichert-Wollny numbers?—We have tried to do that this year, but in practice the result has not been that.

9248. You say the effect of early stabling has been tried?—Yes, they have tried it, and the practical results have not been like this. The farmers or factories in the northern parts of Holland—some of them in a small part of Friesland, one factory, perhaps—have tried stabling the cows earlier, and the practical result has not been that the figures have been higher than in other years.

9249. But it is the fact, is it not, that in a very few days—in a week or ten days—after the cows are put into

Dr. K. H. M. van der Zande and Dr. J. J. L. van Rijn.

28 Jan. 1902.

the stable the Reichert-Wollny number becomes normal?—Yes, but it has not been possible to make the Reichert-Wollny figure remain above 25.

9250. Although it raises the amount it does not raise it above 25; is that your point?—That is so—or 24; I do not know the figures, but I have heard that practically they have not had any results from this experiment.

9251. The figures in the tables we have had from Dr. van der Zande, if I may venture to say so, do not corroborate that, because on the 12th December, when practically the whole of the cows must have been stabled, there is no single instance where the numbers are as low as 25. They are usually 26, 27, 27·9, 28·5, and numbers of that order; that must be due to the influence of warmth and of, perhaps, better feeding?—And I think because it was an exceptional year.

9252. We can only take these numbers which you have given to us?—It cannot be assumed that they are always normal; we cannot do that.

9253. Then you go on to say: "I can now conclude having established for a certainty that the abnormal chemical composition of Dutch butter during the autumn must be attributed to the circumstance that the farmers leave their cattle in the meadows until late in the year"—you say that without any qualification at all?—Yes, I have said that on these results.

9254. "Abnormal chemical composition"?—These experiments show that, and these experiments in this year and also in the second year have given me the right to come to that conclusion.

9255. You have "also proved that an earlier stabling prevents the calling into existence of the abnormal composition under discussion"?—Yes, I have proved that by these figures. I have seen in the cases I have studied that after the date when the cows were stabled these figures began to rise, but practice does not show that when the cows have been stabled it would be possible to prevent the figures going low.

9256. Your conclusions have been independently tested, have they not, by a French Commission?—Yes, they have been.

9257. That is to say, the French Government has caused a couple of gentlemen, French chemists, to take samples over Holland and to have them analysed in France independently of you, in order to see how far these assertions of yours were correct?—Yes.

9258. And they have corroborated and confirmed your conclusions, have they not?—In a certain direction I believe they have. I received their report some few days before I came to London, but I have not had time to study it. I have heard from Dr. van der Zande, who has read the whole report, that they agree with me in this direction.

9259. I have read the report very carefully, and I may say they confirm your conclusions absolutely, and that the sole cause, in their opinion, for the occasional abnormal composition of Dutch butter is to be attributed to the circumstance that you yourself were the first to point out?—Yes, I understand so.

SIXTEENTH DAY.

MEETING HELD AT

ST. STEPHEN'S HOUSE, WESTMINSTER.

Wednesday, 29th January, 1902.

PRESENT:

The Right Hon. HORACE CURZON PLUNKETT (*Chairman*).

Professor T. E. THORPE, C.B., LL.D., F.R.S.
Major P. G. CRAIGIE.
Mr. CHRISTOPHER DUNN, J.P.
Mr. PATRICK HICKEY.
Professor J. M. THOMSON, LL.D., F.R.S.

Mr. A. E. BALLEINE, *Secretary*.

Mr. ALFRED HENRY ALLEN, F.I.C., called; and Examined.

Mr. A. H. Allen.

29 Jan. 1902.

9260. (*Chairman.*) I understand that you are an analytical and consulting chemist?—I am.

9261. How long have you been so?—Thirty-five years.

9262. What official positions do you hold?—I am public analyst for the West Riding of Yorkshire, for the city of Sheffield, and for some smaller places.

9263. Have you given special attention to the question of butter analysis?—Yes, I have had a large experience in it, and I have given special attention to it.

9264. Have you written on the subject?—Yes, I am the author of a work entitled "Commercial Organic Analysis," which extends over eight volumes, and one of those volumes is devoted entirely to oils and fats, including butter.

9265. Have you ever pursued your investigations in connection with butter in any foreign countries?—Yes; some twelve years ago I was invited by the Danish Government to go to their country with a view of visiting farms which were producing butter of a peculiar character, and in conjunction with the British Vice-Consul and some others, I visited several farms there, and saw the cows milked under stringent conditions, and the butter made under my own eyes, and this butter was analysed by Professor Stein, of Copenhagen, who is the Government chemist, and by myself, after returning to England, with results which showed that these butters were peculiar.

9266. Do you hand in any analyses that you have made, or do you propose to give general evidence upon the results of your experience?—I have not prepared any tables of analysis.

Mr. A. H. Allen.

29 Jan. 1902.

9267. But you can give us the results?—Yes, I am prepared to give you some results.

9268. What methods of analysis have you chiefly employed?—I think I am conversant with all which have been proposed. A great many of the methods of analysis hang together largely on the basis of the peculiarity of the composition of butter-fat as distinguished from other fats. Butter fat contains the glycerides of butyric acid and several closely-allied acids, whereas these are substantially absent from nearly all other kinds of fat than butter fat, so that we are able to distinguish butter fat from those other fats by the presence of this glyceride of butyric acid, which is sometimes called butyrin.

9269. In what respect do those fats differ from what are called non-butter fats?—By the absence of the glyceride of butyric acid; ordinary fats do not, when saponified, yield butyric acid, whereas butter does in a very material quantity. There are one or two fats which simulate butter fat not by yeilding butyric acid, but acids which analytically somewhat resemble it; but those do not really enter into our question particularly, except perhaps in the case of cocoa-nut oil, which is sometimes used as a butter substitute.

9270. Are any fish oils used?—Yes, but they yield valeric acid, which is quite another thing, and is not in question here. I never heard of anybody trying to use a fish oil as a substitute for butter.

9271. Is palm-nut oil used?—Palm-nut oil no doubt is used, and cocoa-nut oil certainly is used, and it complicates the process of butter analysis, because it simulates butter in certain respects.

9272. Can the presence of these oils be detected by any separate process?—You get indications of the presence of cocoa-nut oil in the analysis of butter, which, if there is any considerable quantity present, would enable you to certify to its amount, but you could not do that in the case of a small quantity.

9273. Of all the analytical processes, which do you mostly use for butter analysis?—I use what is known as the Reichert-Wollny process—that is, the Wollny modification of the Reichert process, which is a method based upon the determination of the volatile acids (of which butyric acid is the leading constituent), produced by the saponification of the butter. There are other processes, all of which really are indirect determinations of butyric acid. What is known as the Koettstorfer process (in which the saponification equivalent of the butter is determined), and what is known as the process for determining the soluble acids and the insoluble acids (those soluble acids are mostly butyric acid), are merely other ways of getting at the butyric acid. The solubility of the butter fat in glacial acetic acid also depends on the amount of butyric acid. The specific gravity depends on the amount of the glyceride of butyric acid, and so does the refractive index. So they are all data which hang together, and a sample of butter which gave one result according to one process, would give results according to the other processes comparable with it, and we should expect them all to be in accordance. We are very much in want of some other method of examining butter not dependent upon that peculiarity of the presence of butyric acid. If we could devise a method entirely independent of it, it would be a very great gain, and would enable us to have much greater accuracy in the analysis of butter than is possible at present, not that we cannot accurately analyse, but it is the conclusions from the analysis which are troublesome, in consequence of the natural variations in the composition of butter. If, for instance, butter always yielded on saponification 6 per cent. of butyric acid, it would be very easy, but if the butyric acid varies from 5 to 7 per cent., then it is quite clear that a fat containing no butyrin could be added to a butter containing 6 per cent. of butyric acid; that is, you could add one-sixth of that other fat before you would bring down the butyric acid below 5 per cent.

9274. Then does it not really come to this, that what you want is a new process which will detect the addition of foreign matter to which the low Reichert-Wollny number is due?—Yes, that is what we want; we do not want a method such as we practically have at present of determining butter, but a method of determining the foreign fat in butter.

9275. Is it your opinion that further research systematically undertaken would probably discover such a process?—It is hard to answer, because if I say, "Yes, and I am hopeful," I should be immediately asked "In what direction would you look?" and I am not prepared to answer that. I should be hopeful. We have overcome a great many difficulties in the past, and if it were done systematically by people able to devote their time and attention entirely to it, I should hope that some method might be devised; but if I am asked to point out in what direction to look, at present I cannot do it.

9276. Would you say generally that more ingenuity is expended by the adulterators at present than by the analysts in detecting adulteration?—I do not quite like the term "ingenuity." I think the analysts do their best, but adulterators will always be a step or two ahead of them. We can only get to know of a new adulterant when perhaps it has been in the market some time, or attention is specially directed to it. The adulterators have the very best scientific assistance, and at the same time they have a special object; the public analyst, after all, can only be expected to use known methods. Although many of us certainly have taken steps in that direction, it cannot be regarded as part of a public analyst's duty to make original investigations for the sake of discovering adulterations which are not hitherto known to exist.

9277. Do you not think that if research work were undertaken, say by the Government, an important part of it would be an investigation into the possibilities of further adulteration?—Undoubtedly. I hold very strongly that it would be desirable to have a committee of scientific experts appointed to investigate the possibility of improving the methods of analysing butter and to devise means for the detection of possible adulterations. At present we have gone as far as we see our way, but butter analysis is far from perfect. I should hope that the result of such investigations as I have suggested would lead to the discovery or invention of superior methods which would answer the purpose.

9278. If this Committee found it desirable that some standard should be fixed for the detection of foreign fats, would you take the Reichert-Wollny number as the best available standard in our existing state of knowledge?—Yes, with this qualification, that I do not think it is good enough to be a standard.

9279. (*Professor Thorpe.*) You mean it alone?—It alone or all together. I do not know how it would do to fix a standard. If you adopt the principle of having a standard, and think that we are in such a position as to justify a legal standard such as we have in milk, then a Reichert-Wollny number gives the best chance; but the natural variations of butter are so large that if you fix the standard high you will have the liability of doing injustice, and if you fix it low then you will let in a very great deal of adulterated butter. Of course, they will always adulterate down to the limit, and it is very difficult to say what should be done under such circumstances. The public analyst's point of view is this: If he has any doubt in his mind he does not give a certificate on which proceedings can be taken; that is literally true with a superior butter mixed with some margarine. Of course, we cannot help it. If once you fix a legal limit then people will work down to it. It is not the same as in the case of milk, because there is no evidence that a low Reichert-Wollny figure in a genuine butter is any worse dietetically, or in flavour, or in any other respect than one with a high figure. It is not like deficient cream in milk; that, of course, does reduce the value of the milk. A low Reichert-Wollny figure is of interest to analysts; but I am not aware at all that the butter is any worse for it. So that to go and insist that they must have a certain Reichert-Wollny figure is very nice for analysts, but a man says, "Why should I be restricted? I do not see that the butter is any better for it."

9280. (*Chairman.*) As a question of public utility, the Committee quite realise the distinction between the case of milk and the case of butter, but then the precedent of the Margarine Act, which forbids the incorporation in margarine of more than a certain amount of butter, might form a precedent for this Committee, might it not?—I do not quite see how that follows.

9281. Your objection to dealing with butter as milk has been dealt with, that there is no dietetic objection to a low Reichert-Wollny number?—That is so.

9282. Could it not be said equally that there is no dietetic objection to the addition of butter to margarine, but that it has become necessary to prohibit the addition of more than 10 per cent., solely for the purpose of restricting fraud?—If it is a question of public policy, as you say, it might be more easily done, probably, by insisting that all margarine shall be coloured; then, if it

Mr. A. H. Allen

29 Jan. 1902.

were mixed with butter, it would show itself by the colour. If your object is to prevent moderate additions of margarine to butter, it is done in a moment by colouring the margarine.

9283. What we wish to get your opinion upon is, assuming that the Committee decides to fix a chemical standard such as we have been discussing, which do you think is the best method to apply?—If, in opposition to my own view, they decide upon fixing a standard, then I think the Reichert-Wollny method gives the best chance.

9284. Would you have the Reichert-Wollny method alone, or the Reichert-Wollny method in combination with some of the other tests?—Before I condemned a butter I should apply other tests as well to see that the Reichert-Wollny test was confirmed, and was not in any way in error; but unfortunately they all hinge on the same point, and you can almost predict from the Reichert-Wollny figure what the other results will be.

9285. Is that true of microscopic analysis?—No, that stands on an entirely different basis, only I must confess I cannot make anything of it. In the case of actual margarine, that is to say, margarine when free from butter, actual foreign fats, lard and so on, one can see a microscopic difference between them and butter fat; or rather, here it is not a question of butter-fat, but of butter with impurities in it, and large admixtures of margarine I think I could see; but when it comes to moderate admixtures I confess it breaks down entirely. I have done my best and tried my hardest to discriminate between such mixtures, and have failed.

9286. (*Mr. Hickey.*) What do you mean by "moderate admixtures"?—10 or 15 per cent.

9287. (*Chairman.*) Does the refractive index help you?—No, the refractive index depends again upon the amount of butyric acid.

9288. Does the specific gravity help you?—That, too, depends on the amount of butyric acid. All those hang together. The microscope is an entirely different thing, and if the appearances were found invariably to be such as to enable you to see margarine, why, then it would do a great deal towards solving our difficulty. Personally, I have absolutely failed, although I have tried my best to do it. Then we must remember that there is a great deal more personal equation in the use of the microscope than there is in chemical processes. A man can go through a prescribed chemical process, and if he is a competent manipulator he will get substantially the same results as anyone else, but the eyes will not always see the same things, and he may be a bad observer, or he may have a visual peculiarity. I do think that some microscopists see things which others cannot.

9289. (*Mr. Dunn.*) The personal error is greater with the microscope, you think?—It is greater, and it would be a very disagreeable thing for one man to see a thing which the other cannot see. There might be some method of microscopic manipulation devised—something or other done which might make it more useful, but at present, under my eyes, I have wholly failed with it.

9290. Your opinion comes to this, that in the present state of analytical science you would not recommend any standard to be fixed, based upon chemical analysis?—I would not recommend it.

9291. But you think it desirable that further research should try and establish a chemical analysis which does not depend upon the amount of volatile or soluble acids?—That is distinctly my opinion. I would look for a chemical process in some other direction, but I would by no means ignore the microscope, as I would like to see the microscope used, although at present I think it fails.

9292. Is not a test for foreign fats the only other possible direction in which you can test the introduction of other fats?—Yes. That is where it becomes very difficult to expect one single method to detect any kind of foreign fat, whether it happens to be cotton seed oil, or beef fat, or sesame oil, or whatever it is. It is not very hopeful.

9293. But still, analysts having failed accurately to determine the amount of true butter fat, you now think they should try and learn to accurately determine the amount of foreign fat—that is what it comes to, in plain language, is it not?—I think it is very desirable, but I confess myself unable to point out a direction in which they would be able to do that; I am not even able to give a hint at the present moment.

9294. (*Professor Thorpe.*) You said you were asked by the Danish authorities to investigate some of their butters which were peculiar; in what sense were those butters peculiar?—They were giving very low butyric acid results, or Reichert-Wollny results, which they feared—I do not know whether it had actually happened—would get them into trouble in England. They wanted to have evidence of an unimpeachable kind from an English chemist, that genuine butters were at a certain time of the year liable to give such low Reichert-Wollny results as would be likely to have them condemned on this side. Therefore I was invited to go there, and I went to some of these exceptional farms which were already known to be giving low Reichert-Wollny results.

9295. They were not uniformily and invariably giving low Reichert-Wollny results, were they?—I think not, except that there was a tendency towards that at a certain time of the year. These were farms, however, which were specially selected as being some of the worst instances.

9296. Were you able to connect the occurrence of the low Reichert-Wollny values with anything peculiar to the cow; that is, anything connected with the condition of the cow?—No. They were large herds—70, I think, in one case, and I believe over 100 in another—at any rate, there were very large numbers of cows; the cows were milked in my presence, and the milk was mixed together in a large vessel, and then it was converted into butter without separating the cream. Any individual cow could not have made a difference; it was a large average sample.

9297. Was there more than one place that you went to?—There were two places at a considerable distance apart—30 or 40 miles apart.

9298. Were they in the outlying islands?—One was in the island of Falster—I cannot remember the name of the place; and the other was somewhere down in the south of Denmark, somewhere outside the main island.

9299. The island of Falster is a small island, is it not?—It is compared with the others.

9300. They are none of them very large, but that is particularly small?—Moderately.

9301. Were they the herds of one proprietor?—No, they were quite distinct. The proprietor in Falster was a Privy Councillor, a very well-known, wealthy man, since dead, whose name I cannot remember.

9302. Were those cows all in one condition, for example, as regards the period of lactation?—That I do not remember; I have no doubt I knew it at the time.

9303. I ask you these questions because I myself have had occasion to make some enquiries very similar to what you have made, and I believe these abnormal results are invariably obtained from what I may call, speaking from the modern standpoint of dairy procedure, abnormal practice; that is to say, they invariably occur on the farms of somewhat conservative landowners, who refuse to fall in with what is the general dairy practice. I was wondering whether these were cases of the same kind?—I think my notes would tell me, but I cannot at the moment recollect. I know this distinctly, that these farms were visited just before the cows were taken in for their winter quarters, when they were getting very short of grass, and it was a pretty bleak climate too; therefore they were probably under-fed, or if not under-fed at any rate they were getting their fodder with difficulty. It was probably due to exceptionally bad conditions.

9304. That is to say they were under the same condition which it has been recently found that a considerable number of Frisian cows are at the same period of the year?—Yes. In the case of the Dutch cows they seem to go worse a good deal. Van Rijn seems to have had more remarkable cases than were met with in Denmark; but then that is always the case—the further you extend your experience the greater the variations that are noticed in these natural products.

9305. Is it not the fact that the Danish authorities have done what they can to bring pressure upon their farmers so to accommodate the cows as to obviate the possibility of these low Reichert-Wollny numbers?—Yes. The farmers in Denmark are looked after very paternally. They have the best of Government advice, and competent officials are constantly going round literally to advise them how best to conduct their dairies. That undoubtedly has done the farmers a very great deal of good. The Danish Government, of course, wish to avoid these abnormal samples, because there is always suspicion attaching to them, and I have no doubt whatever that they have greatly improved their butter in that way. As a matter of fact, I do not know much about prices, but I believe at that time, 12 years ago, Danish butter was about the lowest priced butter in the market, and now I believe it commands a very good price.

9306. And that is very largely due, is it not, to its high character, and its uniformly high character throughout the year?—I should imagine that is so.

9307. And that has been very largely achieved by impressing upon the farmers the desirability of so arranging the calving that the character of the resultant butter is of an average condition throughout the year?—I can take it from you, but I cannot say that that is strictly within my knowledge. What I was struck with was the care with which the butter was made, the care in regulating temperature at the time of churning, and the care with which the exact amount of salt was weighed out and added, whereas I am afraid in our ordinary practice in England things are not done so carefully—in other words, they did it as a real manufacture, instead of doing it as a mere handicraft, in a happy-go-lucky sort of way.

9308. Was it some years since that you were in Denmark?—Yes, it was in 1888.

9309. That is the time when you say the Danish butter was at its lowest price?—I believe it was so then.

9310. (*Mr. Hickey.*) Was not your visit the result of prosecutions instituted against Danish butter in England?—Speaking from memory, I think there had been either prosecutions, or threatened prosecutions, or trouble in Manchester. It came to me first of all from the Danish Commissioner, and I do not know the previous history, or do not recollect it.

9311. (*Professor Thorpe.*) Anyhow, I think we are warranted in believing from all we know that the condition of things which you investigated, which to some extent was abnormal even in that time, is much more the exception now than it was in 1888?—I cannot speak from personal knowledge, because I have not analysed Danish butters of late that I know to be genuine.

9312. I think you told the Committee that the characteristic constituent of butter fat as distinguished from all other animal, or even vegetable fats, was the occurrence in relatively large quantities of the glyceride of butyric acid, and of course the immediate homologues of butyric acid?—Yes.

9313. It is that fact of course which no doubt has led analysts to concentrate their attention on the determination of butyric acid as a characteristic of butter fat?—Undoubtedly.

9314. I suppose you will admit that their methods—relatively imperfect as they are—have done a great deal to hold butter adulteration in check?—Certainly, yes; they have been invaluable. Until Hehner and Angell devised their method based upon the determination of butyric acid as soluble acids, we had no definite means of distinguishing butter from margarine, or from other fats.

9315. Therefore you think it would be a very unfortunate thing if this Committee were to give the impression that the methods of butter analysis are so extremely imperfect that nothing could be done in the way of checking adulteration?—I should think it would be a most objectionable and a most untrue impression. It is only when we are dealing with small proportions of margarine that any difficulty occurs.

9316. That is to say quantities of the order that you told Mr. Hickey of from 10 to 15 per cent.?—Yes.

9317. You have pointed out that in your opinion the problem before this Committee is essentially different from that which was before the Milk Standards Committee?—Yes, but I was rather driven from that position by the Chairman, who said that as a matter of public policy it would be possible to take notice of butyric acid. What I said was that butyric acid had in my opinion nothing to do with the actual quality of the butter, and it was only analytically valuable.

Mr. A. H. Allen.

29 Jan. 1902.

9318. No one alleges for a moment that there is any connection between the commercial quality of butter and its particular Reichert-Wollny number. We are looking at it from the point of view of administration, and strictly speaking, from that point of view, the problem before us is very much of the same order as that which was before the Milk Standards Committee?—In that sense it is.

9319. In the case of the milk we had to protect the public as well as we could from the undue addition of separated milk; that is what it came to. We determined after a considerable amount of evidence that a certain limit value of fat should be by regulation established; that of course does not preclude absolutely the addition of separated milk?—No.

9320. It, however, safeguards the public up to a certain point. Our problem here is very much of the same order. You tell us that at present chemists are not able with any degree of precision to entirely prevent, under certain circumstances, the admixture of foreign fat with butter, owing to the natural variations which butter has. The problem there is similar to the case of milk. Owing to the natural variation in the amount of fat which is in milk it was not possible to lay down perhaps as high a standard as we could have done in the absence of these variations. Here again the problem is very much of the same order. We cannot in the case of butter lay down an absolute number on account of the natural variations in the amount of volatile acids, we will say, to which butter is liable. But inasmuch as your yourself have stated that the methods, imperfect as they are, have held butter adulteration considerably in check, can we not on that same basis, or on some basis of a like order, lay down some numbers which will serve to bring about uniformity in procedure among analysts as we did in the case of milk?—I should think it possible. Uniformity of procedure would very soon settle itself, because nearly all analysts rely on some form of the Reichert process, and if the Government were to state a figure analysts would immediately conform to it.

9321. Whilst the system is not perfect (we all allow that), at all events, looking at it from the point of view of public policy and the administration of the Act, would there not be a material gain from the action of this Committee in establishing some limit of that kind?—I see a great deal of difficulty, because if you fix it too high we shall constantly have the defence coming forward to show that it is quite possible it is genuine, and if you fix it too low then you legalise a mixture of 15 per cent. easily.

9322. But the probability is exactly the same as in the case of milk; exactly that set of considerations were brought before the Milk Committee, and were insisted upon very largely by milk vendors and other people who protested against the imposition of any standard at all simply on that ground. Is not the argument exactly of the same order in this case?—It seems to me more difficult, seeing that in the case of milk we were dealing with an article which was produced in the neighbourhood, whereas unless we have knowledge of the origin of the butter the margin that would have to be left would be so excessive as to encourage adulteration. If we could know that it was a German or a Danish or a Russian butter, or whatever it was, then we could allow a less margin, and fix a higher number; but otherwise I am afraid we cannot.

9323. I quite agree, of course, with you that it would be very desirable, especially in view of the seasonal changes to which butter is liable, that the analyst should know, if possible, the origin of the butter, but at the same time, looking at butter as a whole, comparing the butter which comes from the Colonies with that which is produced in our own country, with that which is produced in Denmark, and with that which is produced during the greater part of the year in Holland, we find that there is not that extraordinary variation in the character of butter, and that the limits in the case of the Reichert-Wollny number are really not wider than are the limits of fat which may occur in natural milk; is that not so?—I have no doubt that the great majority of the butters would conform very well indeed to a standard, but I see a practical difficulty, because if the cases are taken into court the defence will always raise the point: "These are abnormal samples."

9324. Of course, the presumption is raised, and it is for the defence to rebut it?—But then it is rather difficult to bring a man from Siberia to rebut it.

Mr. A. H. Allen.

29 Jan. 1902.

9325. But it has still got to be proved that all Siberian butter, for example, gives a relatively low Reichert-Wollny number?—I do not think all Siberian butter does, but still a great deal of it would be excluded, I think, by a Reichert-Wollny figure which would perfectly well satisfy English butter.

9326. Yes, as to some of it at some period of the year; but I think we shall have evidence about Siberian butter which will show that Siberian butter is really not so abnormal as the one or two cases which have been tried make it at first sight appear. As a matter of fact we have a good deal of evidence to show that Siberian butter is not very different from the butter of the rest of the world. You have not been able to indicate to the Committee even an inkling of any improvement in our present methods with a view to a more definite recognition of the presence of foreign fat. I should like to ask you as a chemist your opinion of one possibility—butter is characterised by containing relatively small quantities of stearin, 1 or 2 per cent. perhaps?—It is said to.

9327. All the fats, or practically all—at all events the animal fats—which are used to adulterate butter are characterised by containing a relatively large quantity of stearin, is that not so?—If you take beef-fat to start with, yes; but the oleo-margarine, as they call it in America, where they have separated the stearin, consists mostly of palmitin and olein, and in that you would not have very much stearin.

9328. Is that used largely for the manufacture of margarine?—I believe it is, but I really know very little of the details of the margarine manufacture; it is only from reading and not from observation that I speak as to it.

9329. Where, so far as you know, is the adulteration of butter mainly practised?—Of course, we know that the site of the margarine manufacture is Holland, but where the adulteration takes place I do not know.

9330. What butter has its character most frequently impugned in trade?—That I cannot tell you.

9331. You do not know?—No.

9332. It is not butter from the country where the margarine manfacture is most prevalent, is it?—Where the butter is most adulterated?

9333. Yes?—Unless you accept Van Rijn's figures, I should say it was.

9334. That Dutch margarine has a fairly uniform character, has it not?—I cannot tell you.

9335. Have you not made any examinations of margarine?—I have made examinations of margarine, but my examinations have been simply to see whether it contains 10 per cent. of real butter or an excess of water.

9336. You have not gone further?—I have not investigated as to what oils it is made of.

9337. That is another matter; I am not talking of the oils. The oils, of course, are only present in a relatively small proportion in margarine?—I understood you to ask me if I knew whether all Dutch margarine was made from the same materials.

9338. Or had the same composition?—That is the same thing.

9339. No?—I thought you meant how much cotton seed oil did it contain, and so on.

9340. No, what I am driving at is this: Is it not the fact that in Dutch margarine there is a relatively high proportion of stearin?—I do not know.

9341. Will you take it from me that it is so?—Yes, certainly.

9342. Inasmuch as there is not much stearic acid or stearin in butter—assuming my facts—would not one method of detecting the sophistication of adulterated butter be to search for the presence of stearic acid in abnormal quantity?—It sounds very plausible, but it is complicated in practice by the constant occurrence of palmitin which simulates stearin so closely that I pity the poor public analyst who had to determine the two in every butter that came. I think you see what I mean.

9343. I think I shall have some information to give to the Committee on that point; but you probably have not thought of it?—I have not thought it out, but that initial difficulty occurs to me, otherwise I distinctly recognise that it is a valuable idea to attempt to estimate the stearin.

9344. Some questions have been asked you about the relative dietetics of butter and margarine, but of course that does not enter into the question, I suppose, looking at it from the analytical point of view?—Not from the analytical point of view, but I have an opinion that butter is distinctly better than margarine dietetically.

9345. What do you mean by dietetically—do you mean in nutritive value?—No, I do not mean quite that, though I dare say it does cover that. I know personally of a very well defined instance of a person who is unable to touch ordinary fat, but who can eat butter very thickly spread.

9346. I know an individual in this room who in some circumstances prefers to eat margarine rather than to eat butter?—There is no accounting for taste.

9347. There is one factor on which I venture to say I do not think you laid sufficient stress. You said that all the methods used by analysts were practically in principle very much the same thing, that is to say, they were all indirect methods of determining the characteristic constituents of butter, namely, butyric acid?—Yes.

9347*. Is there not one constituent of butter, namely, olein, which there is a direct method of determining, and which is of importance?—Yes. You are referring to the iodine-absorption process. That is all right enough, because butter gives a better figure than what margarine will give, but that process will not detect 20 or even 30 per cent. of margarine with certainty; you can only base an inference upon getting a somewhat higher or lower iodine absorption. But this method is distinct from the determination of butyric acid, and I beg your pardon for having overlooked it.

9348. I have not the slightest doubt that you will agree with me in this, that many of the inconsistencies in the inferences of the methods, like the relation of the Koettstorfer method to the Reichert-Wollny method and the little aberrations in specific gravity are reconciled by the determination of the oleic acid through the iodine absorption value in many cases, that is, when you have that supplementary fact given to you, many of the little inconsistencies which complicate the inference you draw are explained; is that not the case?—I cannot see that it is. You would have to know the nature of the margarine, whether it was made from cotton seed or sesame oil, and so on.

9349. I am talking about butter for the moment?—Unmixed butter?

9350. Yes; olein is a constituent of butter, is it not?—Yes, but I do not know that it bears any relation to butyrin. I do not know that a butter which is rich in butyrin is poor in olein or *vice versâ*.

9351. I think you inadvertently led the Committee to believe that the aberrations and variations in specific gravity and the variations in the refractive index—in fact, all the constituents, really depended upon the butyrin which is present?—Yes, I think so.

9352. I wish to point out to you that they are also connected with the amount of olein which is present?—That may be so. I do not know the refractive index of pure olein as compared with palmitin and the other constituents of butter, so I cannot say.

9353. I think you will agree with this statement that, relatively imperfect as the methods of analysts may be, that is to say, inasmuch as they are all matters of inference, they are not absolute and direct determination of the amount of the foreign ingredients, nevertheless they do protect the public very considerably within certain limits?—Very considerably; in fact, of late, since the new regulations of the Board of Agriculture, I have not seen any doubtful butter, that is, any butter which I should have thought contained a small quantity of margarine, so I take it that the old practice of mixing margarine with butter has died out. I think the trade are not now mixing as they used to. Of course they used to have half and half mixtures, and they used to get down to still smaller mixtures of margarine. Now that it is legally prohibited to have anything more than 10 per cent. of butter, I think these mixtures have largely disappeared.

9354. In other words, as a butter merchant said to me, "You have killed our shilling trade"?—Yes.

9355. (*Mr. Hickey.*) Could you tell the Committee what was the probable Reichert-Wollny figure in the Danish butters that you examined in 1888?—One sample which was called "B" gave 22·63 by the Reichert-Wollny process, when examined by Professor Stein and myself in Copenhagen, and 22·39 after my return to England, when examined by myself. Another one, "O," gave 24·39 in Copenhagen and 24·70 in London. The average butter-fat received from Professor Stein gave, in my hands, 29·2, so you may say the Danish butter at that period gave an average Reichert-Wollny number of 29·2.

9356. (*Professor Thorpe.*) Would it be a Reichert-Wollny number in 1888?—Yes. The Reichert-Wollny process was published about a year before that, and when I went over to Copenhagen I found Stein working it for all the butters that he examined. We worked it together, and I believe I was the first to practise it in England. I brought it over with me then; it was the Reichert-Wollny method strictly.

9357. (*Mr. Hickey.*) Have you any knowledge as to the probable percentages of the Danish butters imported into England at present that would come under 25 Reichert-Wollny?—No, I know nothing about it at all.

9358. (*Mr. Dunn.*) You mentioned in your evidence that you did not approve of fixing a limit?—I am afraid of it. I do not disapprove of fixing a limit, but I see so much practical difficulty at the present stage. It would be a great comfort to analysts to have a limit fixed.

9359. I am looking at it from a public point of view. I think you said that the strongest argument to put against it was that people would be apt to work down to it?—Yes.

9360. Do you think there would be more danger of working down to a low limit if a limit was fixed than if no limit was fixed?—I feel this, that if a limit was fixed and it was very low one, one would be bound to pass every butter above, whereas if we had any knowledge of butter coming into market and known to be produced in a country district of England, and so on, one would be able to take a higher figure if we were not tied by a Government figure.

9361. You think, the limit being unknown, that it is a greater terror?—Yes, because then they do not know exactly the practice.

9362. They do not know where they would be?—No.

9363. Is that the experience of the result of fixing a limit in the case of milk—that it has checked fraud?—I believe it has. As a matter of fact, we have had much better milk since the fixing of that limit than was to be seen before. The amount of fat now is generally from 3·6 to 4 per cent.

9364. (*Professor Thorpe.*) Really?—Yes, very often; it is rarely under 3·5.

9365. (*Mr. Hickey.*) From a public point of view, there may be a stronger case for a milk standard than for the fixing of a Reichert-Wollny number for butter, because in the case of milk it really expresses the quality of the article?—Yes.

9366. Whereas it does not necessarily do so in the case of butter; but, nevertheless, the experiences is that the fixing of a limit has improved the quality of milk?—It certainly has, materially.

9367. Do you not think it might improve the quality of butter?—If you can fix a high limit, yes; but then you will probably exclude some of these foreign butters. That will be good for British trade. If you fix a high limit, it will improve matters; if you fix a low limit I am very doubtful. I take it that the ordinary dairy farmer in England will not adulterate his butter systematically—that is, he will not do it scientifically; he will not go and have it analysed, probably, to see what the Reichert-Wollny figure is in his own butter, and to see how much it will stand—but the Dutchmen will.

9368. I do not think it is the farmer who will do it, but the butter factory owner might?—Yes, he might.

9368*. It would not be worth while to do it on a small scale?—No.

9369. (*Chairman.*) If a limit were fixed, at what Reichert-Wollny number would you fix it?—I should be bound, in view of what I have seen, to take a low figure, but I rather protest against being asked to fix a figure when I object to a figure being fixed.

9370. (*Professor Thorpe.*) What do you mean by a low figure?—I mean as low as 22 or 21 or 20 cubic centimètres even.

9371. (*Chairman.*) But such a limit, I understand from the drift of your evidence, would be absolutely useless?—I am afraid it would do more harm than good if you fixed it as low as that, but if you fixed it at 24 or 25, at 24 even, I believe there would be no difficulty in anybody except these foreigners complying with it.

Mr. A. H. Allen.

29 Jan. 190

9372. (*Professor Thorpe.*) Supposing I told you that of 650 analyses which had been made of Friesland butter—the butter which is most subject to this variation of all the butters which have come under our notice, with the possible exception of Siberian butter, which is still *sub judice*—but still the facts as regards Frisian butter have been more carefully ascertained perhaps than as regards any other butter—if I told you that of 650 samples of Friesland butter which have been collected throughout the year 21 only were below 25 Reichert-Wollny, and of those 21, 14 were above 24, would you think that any practical hardship would result to Friesland butter from the imposition of a Reichert-Wollny number of 25?—No, I do not think so. We could afford to do without it.

9373. If you are further told that the general characteristics of Friesland butter are fairly typical of Dutch butter in general and of Danish butter, what becomes of the contention that any Continental butters, with the possible exception of Siberian butter—which is, as I still again say, *sub judice*—would suffer hardship by the imposition of a limit of 25?—It would seem that there would be very little hardship, but they would fight and get the benefit of the doubt, and there would be, I am afraid, litigation in consequence, which the local authorities resent very much.

9374. Let me again point out to you what the position of matters is: If we raise the presumption—and I think that statistics show that we are reasonably just even in raising the presumption—at 25, and if under these abnormal conditions, many of which are avowedly preventible by a little care on the part of the farmers in being more humane to their beasts—feeding them properly and housing them properly—they themselves could prevent it; where is the injustice in raising the presumption and in calling upon people under those circumstances to do their best to avoid these conditions?—I do not think there is any injustice, and I think it would do a great deal of good, but you will find that in practice there will be some very hard-fought cases where the unfortunate public analyst will have to bear the brunt, and he will get abused.

9375. (*Chairman.*) Then it is in the interest of the public analyst and not in the interest of the public that you object to a limit being fixed?—No, but I see what it means. I see that the local authorities, if you fix it at 25, and I find a case—an instance—of 24, will say, "We shall not take that into court," or even if I find an instance of 23 they will say, "We shall not take that into court."

9376. (*Professor Thorpe.*) They might or they might not?—I am speaking of what I expect.

9377. How is the public analyst to get knocked about? The Board of Agriculture, I presume, if it fixes this limit of 25, will take the responsibility, and it is by the direction of their regulation that the public analyst does his duty. He says, "Very well, the regulation is that the presumption is raised at 25." How is the public analyst to be blamed for that?—By the fact of the case being dismissed.

9378. I do not think so?—If you were a public analyst you would think so.

9379. The dismissal of the case merely means that the presumption has been rebutted?—That does not come out. It is a question that Mr. Smith was summoned at the instance of the authorities on the certificate of the public analyst for selling butter which did not comply with the requirements of the Board of Agriculture; he gave a certificate of 24 cubic centimètres instead of 25, and the learned stipendiary, after a careful hearing of the case, decided to give the defendant the benefit of the doubt, and the case was dismissed, with costs against the corporation.

9380. Of course, we are all liable to that sort of thing; but how is there a stigma attached to the public analyst in consequence of that?—You will find that it will be headed "Erroneous Analysis of Butter: Alleged Adulteration Disproved," and so on; and a nice advertisement for the analyst it will be.

9381. I think you are proof against all that; that sort of thing will not affect you?—We have difficulties with local authorities, I can assure you, to contend with which are appreciable. They will not take proceedings when it is only a trifle under the standard which has been fixed. We had that out, I remember, in the case of milk.

Mr. A. H. Allen.

29 Jan. 1902.

9382. That is another matter, of course; how far it is expedient for the local authority to move is a question for them, and you have nothing to do with that—you make your analysis and you are answerable for the accuracy of your work, then you as an analyst obey certain regulations, and there your responsibility, it seems to me, is at an end?—Yes, but that is not the view which the public take of it.

9383. (*Mr. Hickey.*) Is your chief objection to the fixing of a Reichert-Wollny limit of 25, that skilled adulterators would work down to that if such a limit were established?—There is not very much margin for working down if that limit is fixed at 25. I think if you fix 25 you will abolish the addition of small quantities of margarine. But if you fix 20 then there will be ample margin for adulterators to make a profit on it, especially in the case of those who do it systematically.

9384. Have you come across a large number of samples that have given a Reichert-Wollny figure varying from 25 up to 33 or 35?—35 is very exceptional. The butters usually vary, I should say, from 25 to 31 or 32; I should fix an average butter at about 28.

9385. Then if a butter had a Reichert-Wollny figure of 30 and a limit of 25 were established, it would permit with perfect safety adulteration to the extent of 15 or 20 per cent.?—Yes.

9386. (*Professor Thorpe.*) Something surely would depend on how the regulations are framed.—I venture to say that if a man had got a butter with a Reichert-Wollny value of 31 or 32, although it is possible that he might add 20 per cent. of margarine, and so bring it down to 25, that fact would be detected by the analyst?—I do not see how if you are going to fix the limit at 25.

9387. I am not going to make that the sole condition. I should not say that all butters must have a Reichert-Wollny value of 25 and *ipso facto* no questions are to be raised in the case of butters which have that value. All that depends upon how the regulations are framed, and I should hope that any regulations which the Board of Agriculture may frame would allow the analyst to use collateral methods in addition?—Yes, he should have collateral information of all kinds. At the same time as it stands now the analyst has got nothing whatever to go to in the way of collateral information; a sample is brought to him simply under a number.

9388. Collateral information derived from other processes he has?—I misunderstood you; I thought you meant collateral information as to the origin of the butter and so on. If you fix a Reichert-Wollny limit of, say, 25 and the butter is above 25 the tendency of the busy analyst who does not go into it perhaps as thoroughly as he might do would be to say, "That passes muster; we cannot condemn it," and there is an end of it. You must not ask him to make an absolutely exhaustive analysis of every sample of butter if the Reichert-Wollny figure is exceeded.

9389. I venture to say that when a man had manipulated a 31 or 32 Reichert-Wollny butter to bring it down to 25 that fact would incidentally come out; supposing the analyst at once went to the Reichert-Wollny determination and found 25 he would also find other characteristics about the butter which would raise a presumption in his mind that that butter had been tampered with?—Do you mean to say that the analyst's attention would be directed to that by some peculiarity?

9390. Yes?—I should not like to promise that.

9391. In any case would it be exceptional that he would apply other tests?—I do not think he would be inclined to do it if you fix 25 as the number. If a low Reichert-Wollny were fixed such as 20 or 21 there would be every encouragement given to adulterators.

MR. WALTER COLLINGWOOD WILLIAMS, B.Sc. (London), re-called; and further Examined.

Mr. W. C. Williams.

9392. (*Chairman.*) You have already appeared before the Committee, so I need not ask you any of the formal questions as to who and what you are. Do you appear on this occasion on behalf of any body?—I appear on behalf of the Association of Municipal Corporations, I presume. I have been asked, indirectly you understand, through the Town Clerk of Liverpool, to appear on their behalf.

9393. (*Professor Thorpe.*) I think it would be convenient to know whether you are speaking what you understand to be the mind of the Association of Municipal Corporations?—I do not know what the mind of the Association of Municipal Corporations is.

9394. (*Chairman.*) Then you are only giving your own personal opinion as an expert?—I am really giving my personal opinion. They asked to have a witness, I suppose, and the Town Clerk suggested my name, and that was accepted.

9395. You have no instructions from them?—I have no instructions whatever from them.

9396. (*Professor Thorpe.*) You are merely representing yourself then?—That is really so.

9397. (*Chairman.*) Have you come to a decided opinion as to whether any test or limit should be laid down under Section 4 of the Sale of Food and Drugs Act for determining the presence of foreign fats in butter?—Yes, I think decidedly it should not be done.

9398. For what reason?—Because the natural variations in the composition of genuine butter-fat are so very large—they are very much larger than was at one time supposed.

9399. If the Committee were to decide to fix some standard, what would be the analytical method upon which you would recommend them to rely?—I would not care to rely upon any single method. I should prefer to use as many as possible.

9400. Would you take the Reichert-Wollny process?—That process would certainly be one; it would probably be the sorting method used in the majority of cases.

9401. Is not that method recognised by analysts on the whole to be the best for general purposes?—For the purpose of present-day adulteration, but then of course there may arise adulteration with other substances or fats to which the Reichert method would not be applicable. That is, I think, one of the objections to fixing a method.

9402. In respect of what butters in your experience is the greatest variety of conditions found?—I have personal knowledge of cream from Irish dairies, and of butter churned by myself from that. The other information I have on the subject is derived mostly from reading, but as to that butter I have personal knowledge that the samples were genuine, and it is with regard to that that I found these variations which I have mentioned in my synopsis of evidence.

9403. I take it you are opposed to a standard, because to cover all genuine butters with a low Reichert-Wollny number it would be necessary to fix the standard so low that it would open the door to an immense amount of adulteration which could not be detected under the standard?—It would practically legalise a large amount of adulteration, I think.

9404. As a chemist, can you suggest any means of detecting the presence of foreign fats beyond those which are already in use?—I have nothing to suggest beyond those that are already in use; of course there are a great many more than the Reichert-Wollny method.

9405. Do you think that further research is required to deal with the question of foreign fats?—I certainly do think so.

9406. (*Professor Thorpe.*) But you cannot indicate what direction such research should take?—I should think one direction which might possibly be hopeful would be a further examination of the composition of the volatile fatty acids, and the fractionation of them, so as to ascertain whether the lowering or the raising of the empirical number in genuine butter is caused by variation in the relative proportions of the butyric and caproic acids; whereas in adulterated butter containing, say, beef-fat, there would be an equal depression in both figures, their relative proportions remaining unchanged. That is a possible direction, but I do not know that it would lead to any result. I have begun to initiate some experiments myself in that direction, but I have not got very far.

9407. Are you aware that such experiments have already been made?—Of course it is Duclaux's method I am thinking of.

9408. A large number of determinations have been made of the relative proportions of caproic, caprylic, and butyric acids in butter; you are aware of those, are you not?—I am aware of that, but I do not know where they are to be found, nor to what butters they refer.

9409. Those are all at your hand; they are all available?—I prefer to get my own figures.

9410. Is there anything else you could suggest as likely?—I consider myself that the microscopic examination under polarised light is of considerable value; but at the same time that is not an absolute distinction, because the same effect as you get with the admixture of margarine may be produced by a physical change in genuine butter; consequently you cannot say definitely from microscopic examination alone that the butter is not genuine.

9411. Your general position appears to be this: that the natural variations in butter are so wide in your opinion that it is hopeless to fix in the abstract interests of justice upon a limit which shall not be open to the objection that whilst protecting the innocent man it opens the door to fraud?—That is so, and of course, the converse.

9412. If you fix a high limit you punish the innocent man, more frequently, and if you fix a low limit you encourage fraud?—Yes.

9413. Have you formed, in your own mind, any idea as to the relative importance of the extreme limits that you have found; how frequently, for example, do you get what I call an abnormal Reichert-Wollny number—that is to say, a very low Reichert-Wollny number—in butter?—At this time of the year we get a fairly low figure in most cases. I am talking, to some extent, in a foreign language, because I do not use the Reichert-Wollny figure myself; I always calculate the volatile acids in terms of butyric acid, and so I cannot always give off-hand the number of cubic centimetres. I should say that about 4·5 per cent. of butyric acid is quite a common figure at this time of the year.

9414. That number of 4·5 per cent. is in a sense a fictitious number, that is to say, it is fictitious in this sense, that you have calculated it from the number of cubic centimetres of the solution required to neutralise it, and you have used a particular factor to turn it into butyric acid?—Quite so.

9415. Whilst you know at the same time that a portion of it is both caprylic acid and caproic acid?—Yes.

9416. What is the advantage of representing it in that way over the generally accepted Reichert-Wollny method?—Because we did it that way before the Reichert-Wollny method was introduced in the case of the soluble acids, and it has been carried on ever since.

9417. It is not an article of the British constitution, is it?—No.

9418. (*Chairman.*) The Reichert method was introduced about fifteen years ago, was it not?—Yes.

9419. (*Professor Thorpe.*) You are singular in this respect, as compared with the great bulk of analysts, who all talk the same language, and understand one another when they speak of the Reichert-Wollny number; why do you persist in that way, may I ask?—I think our method of statement is more intelligible to the courts. At any rate we have got used to it, and the figures are familiar to our minds. Another thing is, that I do not usually use five grammes of fat, I use three.

9420. You are singular in every respect?—Therefore I should have to calculate my three grammes into five. Still I will translate the figures without much delay. My analyses were merely for my own information, and without any idea of submitting them to a Committee.

9421. You cannot, as of course you know, really translate the indications of three grammes into five grammes, having regard to the fact that the Reichert-Wollny number is a number obtained under particular and well defined conditions?—That is so. It would not be strictly the Reichert-Wollny number, but it would bear a proportionate relation to it.

9422. The number obtained from 3 grammes does not bear a proportionate relation to the number obtained from 5 grammes, because you have altered the conditions, and the things therefore are not commensurate?—The relative proportions of the distillate and so on are the same from 3 grammes as from 5.

9423. Is the relative time of distillation the same; are all the conditions the same?—I expect our time is rather longer.

9424. You upset the validity of the whole thing at once in that way; the things are not, strictly speaking, comparable, are they?—No, they are not absolutely the same, but I think they are tolerably comparable.

Mr. W. C. Williams.

29 Jan. 1902

9425. They are only of value, I venture to think, as qualitative indications?—As indications of variation, yes.

9426. They have no more absolute value than that?—They have just as much as the Reichert-Wollny results, which are themselves only relative.

9427. I do not quite know how to take you; it is very difficult as you are talking to us in a language which this Committee do not understand?—I do not think there is really much difference.

9428. (*Chairman.*) Have you assumed that there is a constant relation between your method and the ordinary method to which Professor Thorpe has referred?—Yes.

9429. Then you can translate the one into the other?—I find a general agreement between my results and those of others.

9430. What does the 4·5 of butyric acid that you spoke of just now work out to in the Reichert-Wollny number? (*Professor Thorpe.*) On your assumptions?—On my assumptions 25·5.

9431. Is that your minimum number?—I do not say it is the minimum, but I say that is fairly frequent.

9432. (*Chairman.*) You gave that as a low number, did you not?—Yes. I should consider that as a low number, but, of course, I have found much lower.

9433. (*Professor Thorpe.*) You cannot positively say that it is 25·5; it might be 25 or 26?—I do not think there would be very much difference because on repetition we get very closely concordant results.

9434. On repetition of what?—On repetition by the same process.

9435. That is, your conditions being the same, you get constant results?—Even when the conditions vary somewhat as to the time of distillation, and so on, I have not found that very great variation which is sometimes represented.

9436. Your position is this: that you think butter varies naturally so widely that you do not think it is possible to fix any definite limits by statutory means?—Yes.

9437. Is it not the fact, that on the whole, the great mass of butter is fairly uniform in character; I do not say that it has always the same Reichert-Wollny number, as there may be variations of two or three degrees, but that the exceptional cases of low Reichert-Wollny numbers are comparatively infrequent?—I do not think that the figure I gave you—25—is infrequent.

9438. That may not be?—But I should regard that as a very low limit; in the summer time it is more like 30 or 32.

9439. In your experience, how frequently do you think you get a limit lower than 25?—I do not think I could tell you, and even if I could, the figures would not prove much, because the samples officially submitted to me are, as a rule, of unknown origin, and I have no absolute knowledge of their purity or otherwise.

9440. That is really what we, as a Committee, want to know; if butters are very frequently below 25, of course we could not dream of the idea of fixing 25 as a limit at which the presumption should be raised; everything depends upon how frequent the cases are?—I do not think they are very frequently below 25, but they are very frequently above 25, and if any limit were fixed at all to do any good it would have to be a high one.

9441. Higher than 25?—Yes.

9442. Supposing this Committee were to suggest to the Board of Agriculture that as regards the Reichert-Wollny number—taking only that as one criterion which may be laid down in the regulations—it should be 25, what would be the practical inconveniences of fixing 25?—It would mean that a great deal of butter could be adulterated systematically down to 25. The larger commercial houses would know exactly to what point they could go; and they could have the butter adulterated and then analysed, or *vice versa*, and they would know when they were safe.

9443. What amount of adulteration would be possible—what amount of admixed foreign fat?—About one-fifth—15 to 20 per cent.—in many cases.

9444. In many cases?—Not in all cases, of course.

9445. What would that mean as an initial Reichert-Wollny number to which 20 per cent. of foreign fat could be added?—About 31.

Mr. W. C. Williams.

29 Jan. 1902.

9446. Is that a very frequent number?—In summer time I think it is; summer butter reaches that generally.

9447. Have you got any evidence to show as to the relative frequency in which these numbers occur?—No, I am afraid I have not, that is only my general recollection. It is frequently well over 5 expressed as butyric acid, and I should say that 5·28 expressed as butyric acid represents the Reichert-Wollny number of 30. That is quite a common and usual figure in summer.

9448. Supposing that the Reichert-Wollny number of average butter were about 27 or 28 (and taking the butter of the world, I think that is about its number), do you think it would pay anybody to bother about putting in a sufficient amount of foreign fat to bring it down to 25?—I could not say; I should think it is quite possible, because it is not a question of the actual profit involved in that particular adulteration. Where the profit comes in is in enabling a man to slightly undersell another and so to secure the trade. If the thing can be so worked as to undersell a competitor by a fraction, say a shilling—I do not think it could be much less than that—or 6d. a hundredweight, then that butter secures the trade to the exclusion of the other man's butter. Of course, it is the same with other things too. Adulteration that in itself is hardly payable is payable in that way.

9449. (*Chairman.*) That is, of course, assuming that the quality is not affected?—Yes, it is on that assumption, and I do not think that the quality would be materially affected.

9450. (*Professor Thorpe.*) Amongst other tests that you have given us is the refractive index of butter. You express your method somewhat differently from the rest of the analytical world there, do you not?—The reason is, I suppose, that I have got an Abbe-Zeiss large refractometer, which reads refractive indices directly, and naturally I have given the results in what I thought the most scientific way.

9451. Why have you taken the number at 25 degrees Centigrade?—Because that temperature is the one which is recommended to be used by Wollny, and I have found it convenient.

9452. But that is an instrument which is not primarily adapted to the examination of butter, is it?—It is adapted to the examination of any liquid.

9453. It was primarily for the examination of oils, was it not?—No, it is of general application; there is a pamphlet accompanying it giving directions for its use and so on, and in that there is a considerable article by Wollny, dealing with its use for the detection of adulteration in butter. It is not Jean's "oleo refractometer."

9454. Then it is not the Zeiss instrument?—Yes, it is.

9455. It is made by Zeiss, but it is not what is commonly known as the Zeiss instrument, is it?—It is not the butyro-refractometer, with a scale inside the eyepiece, it is an instrument with a moveable prism attached to an index which moves over a graduated arc reading the refractive indices directly.

9456. How much butter do you require for examination by it?—One or two drops—just enough to form a film between the surfaces of the prism.

9457. What is the principle of the apparatus?—It measures the angle of total reflection.

9458. Why do you determine it at 25 degrees Centigrade, because at that temperature butter is not liquid?—If it is melted previously it does not solidify at 25 degrees.

9459. It is in a partial state of solidification?—If it is allowed to stand a long time it becomes solid, but not if it is examined immediately.

9460. You never know exactly what condition it is in at 25 degrees Centigrade; it is then in a semi-fluid condition; it is in a sort of emulsified condition?—It is viscous.

9461. It is neither wholly solid nor wholly fluid?—It is transparent, and the reading can be taken readily.

9462. That may be, but that depends on the nature of the butter. A butter which gave a low Reichert-Wollny figure, but which had a high melting point, would be at that temperature practically absolutely solid; but if it contained a large quantity of olein, if it was grass butter, produced in summer, and was rich in volatile acids, it would probably be more or less liquid—is that not so?—I do not find any practical difficulty with it.

9463. There, again, you have given us numbers which I cannot make anything out of; you may understand their significance, but neither I nor anybody in the habit of making observations on the refractive character of butter, can make anything of them, because you have worked them, I may say, under conditions which are peculiar to yourself?—I work under conditions which Wollny worked under. When I first commenced to use the instrument I adopted his method of working, and have kept to it since. Of course, the point I am urging is to show the variations rather than the absolute amounts.

9464. This is the whole point really that I am on?—If I were urging you to fix a standard, of course I could understand your objections much more clearly.

9465. You give us extreme numbers, but what is really pertinent to the enquiry is the frequency of the extremes?—I have also sent in the curves of variations of those butters that I know to be genuine at different times of the year. Those curves would show you something of the frequency, would they not?

9466. Not necessarily?—They show you the time during which the high conditions prevail, and the time during which the low conditions prevail; what happens at one place is likely to happen at another.

9467. Are there as many examples at one period as at another. I mean are the numbers upon which these curves are founded as numerous at one time as at another?—I think each of the curves refers to one series of samples.

9468. That is what I do not know. This is the curve (*producing the same*)?—That refers to one sample a month from the creamery, or one sample a fortnight in the earlier part of the curve.

9469. (*Chairman.*) In the figures you have handed in I think you have given the maxima and the minima, but I do not see anything to indicate the number of analyses?—These samples from Drumcliffe, or the other places mentioned, came in one at a time.

9470. (*Professor Thorpe.*) One sample a month simply?—One sample on the 1st of June, one sample on the 1st of July, one sample on the 1st of August, and so on.

9471. Are they always from the same cows?—That I could not say. I do not know.

9472. In other words, are the conditions throughout the whole time absolutely correspondent?—I could not give evidence as to that, because I have not control of that.

9473. Of course we cannot draw much from them in that case, unless the conditions are strictly comparable, how far those are accidents and how far they are in obedience to a natural law we cannot say?—No, except that one observes the same thing so frequently in different places and in different years.

9474. What is it in your view that these curves teach?—That there is a variation, as I express it, of about 2 per cent. of volatile acids between one part of the year and another, occurring in certain cases.

9475. Would you kindly explain exactly what you mean by that; are they seasonal changes?—They are observed according to the season; but I do not think the season is the cause of them.

9476. What in your opinion is the cause?—What appears to me to be the primary cause is the course of the period of lactation. The cows when they are in full milk, and also out at grass, give butter with a high amount of volatile fatty acids, but as the cow becomes dry, and gives less milk, the amount of volatile acids progressively decreases.

9477. That observation has, of course, been made before?—Yes, I have only verified it for myself.

9478. To that extent your observations are valuable. Have you taken the same cow at different periods of lactation?—I cannot say what cow I have had. All I know is the information I have got from the creameries where the cream has come from as to the conditions of calving in their district. I have information here, for instance, from Drumcliffe, in which they say that the cows calve from March to May in the district from which they draw their milk supplies.

Mr. W. C. Williams.

29 Jan. 1902.

9479. You have cows then at all periods of lactation within those limits of time?—Yes, within those limits. It was also mentioned that they get more milk in a day in summer than they do in a month in winter, and that the cows are in full milk when the figures are high and becoming dry when the figures are low—Ballyvistea is much the same, the cows calve there from February to March, and there it is nearly all grass feeding.

9480. To that extent, of course, your testimony is on all fours with what we already know, that lactation has a certain amount of influence upon the amount of volatile acids, that about 10 days after a cow has newly calved the volatile acids ought to be at the maximum, and that they gradually get less and less as the period of lactation progresses, that is what you find?—Yes.

9481. That is what Nilson found many years ago, is it not, and what other people have found since?—Yes.

9482. Nilson also found what precise variation was to be put down to that cause. He found exactly what the influence of lactation was upon the character of the butter as regards the volatile acids?—Yes, but I am not acquainted in detail with Nilson's results.

9483. I thought that was a chemical classic almost; it was a very full paper done under absolute conditions. Nilson was the head of the dairy school at Stockholm, and he was a distinguished scientific man, who turned over to the chemistry of agriculture. He had opportunities of making these experiments, and he did them in a very scientific way. We know from Nilson's numbers amongst others precisely what amount of influence lactation has upon the proportion of volatile acids, when butter is produced, as in Denmark, where the distribution of the calving is arranged all through the year, the influence of lactation on the manufactured product is very largely minimised, is it not?—That would be so.

9484. Therefore you get a very much higher average condition of things?—Yes, if you have those conditions.

9485. You say in your synopsis in reference to the variations which have been observed by others in different countries "although they are generally manifested according to season, it is clear that season is not the whole nor perhaps the principal cause of the widest divergences"; do you mean there that the period of lactation is the principal cause?—That is what I incline to think. I think that food may have a minor effect, but not a very large effect.

9486. But lactation is the primary cause of the change?—Yes, but at the same time there are some results published by Dr. Veith, I think, from the Aylesbury Dairy Company's farm at Horsham, in which he states that neither lactation, nor feeding, nor any of the usual conditions were in any way calculated to cause variation, that is to say the cows were calving at various times of the year, and the feeding was nothing abnormal; the cows were well kept in very well ventilated sheds, and in every way under model conditions, and still he found a variation.

9487. Those are results from individual cows?—They were results from a large number of cows. I do not know whether I have sent this curve up; I plotted it from his results, and below I show the results that I got from the Ballyvistea Dairy, where the calving is nearly all at one time of the year *(handing in two curves)*.

9488. I see you have Reichert-Wollny numbers here?—I suppose so. He gives them as such. So far as one can understand all the usual artificial causes of variation have been eliminated in the Horsham case.

9489. You mean the influence of lactation?—Yes, and the influence of imperfect housing, or very poor feeding, or anything of that kind.

9490. Why do you say in your synopsis that the terms of our reference are not sufficiently comprehensive to enable us to deal with the subject adequately?—I think that such an item, for instance, as the specific gravity or the refractive index could hardly be fixed under the terms of this section of the Act.

9491. *(Chairman.)* The reference is: "To inquire and report as to what regulations, if any, may with advantage be made under Section 4 of the Sale of Food and Drugs Act, 1899, for determining what deficiency, in any of the normal constituents of butter, or what addition of extraneous matter or proportion of water in any sample of butter shall, for the purpose of the Sale of Food and Drugs Acts, raise a presumption, until the contrary is proved, that the butter is not genuine." That is sufficiently general?—It speaks of the normal constituents; the specific gravity, and other physical data cannot be called constituents.

9492. You are confusing what we are to determine with the method of determination, are you not?—The reference speaks of the deficiency of a constituent. I can understand that you may say that the volatile fatty acids are constituents, and you may make regulations about those, or you may make regulations about the amount of any of the chemical components, but when you come to the microscopic examination, and the physical examination, I do not see that that comes within the reference.

9493. *(Professor Thorpe.)* I do not see that we are precluded from dealing with those?—I understand that this Section really refers to proximate constituents.

9494. I should like to be quite clear upon this. Do you think that we cannot posibly do anything with this reference?—You can do something, but you cannot do as much as I think would be desirable.

9495. Do you say that under the terms of Section 4 it would only be possible to fix limits for the chemical constituents of butter-fat?—Yes, that is because they are the only things that are "constituents" of butter-fat.

9496. But we can make regulations for determining when the presumption shall be raised, and we can use any criteria we please to raise that presumption. How is the Board of Agriculture precluded from using any facts—be they physical, be they chemical—for raising a presumption?—You have to determine what deficiency in a constituent shall raise the presumption.

9497. By the use of certain criteria?—What constituent are you determining the deficiency of by the specific gravity, for instance?

9498. We might conceivably be able to do that. What are you determining by your indirect method of calculation and by your arithmetic, and what are you determining when you distil over your three grammes?—I am not making regulations under the Section.

9499. You are working under the Section of the Act—you may not know it but you are. I do not think I need labour that. You say in your synopsis. "In connection with the chemical methods now employed for detecting foreign fats in butter, it would be an essential point to lay down not only numerical limits, but full working details of the processes to be employed." What is the practical inconvenience of defining those if we knew them accurately?—It proceeds too much on the assumption that chemical analysis is a mechanical process, but it is a very difficult matter to ensure uniform results in different laboratories even when we do know the process.

9500. Surely the more mechanical the process is, the easier it is to ensure uniformity?—Yes, but then some of them are not mechanical; some of them require a good deal of personal skill.

9501. Has it not been the fact that the precise mode of prescription of Wollny of the method of working the Reichert process has enabled analysts to obtain absolutely concordant results; is not that a notorious fact among analysts?—In regard to that particular process, it might be done.

9502. Has it not been a very great convenience to the analytical profession to be brought all into uniformity of procedure in that way?—Yes, I daresay it has.

9503. Therefore what is the inconvenience or abstract undesirability of doing that kind of thing?—I say it is very difficult—not that it is undesirable. I doubt the practicability of such regulations.

9504. Then you admit that when it is possible it is desirable?—Yes.

9505. Again you say, "To invest certain analytical processes with the direct sanction of the law would tend to give disproportionate influence to those tests, and would discourage the use and investigation of new methods." Of course that is an opinion of yours?—Yes.

9506. I suppose that is a matter of opinion wholly?—Yes, I certainly do not think we should tie ourselves down to any one process, because the character of the adulteration may change altogether.

9507. Granted! I admit that there ought to be elasticity, and that is the exact reason, I may tell you, why Section 4 was drawn as it was, giving power to the Board of Agriculture to make regulations. We

Mr. W. C. Williams.

29 Jan. 1902.

designedly kept out of the Act of Parliament certain processes, it being a much more elastic kind of machinery to give the Board of Agriculture power to make regulations in order that those regulations might be at the instigation of the Board of Agriculture modified from time to time, as they thought fit. What is the possibility of the thing becoming stereotyped in the way that you dread?—I agree that this course is better than direct enactment of a process by Statute, but I think that a process once having been established by the Board of Agriculture, it will take a good deal of moving to get it altered.

9508. It is not established by Statute?—The regulation will have statutory force.

9509. So long as it is a regulation, but it might be modified six months after it is issued; it is perfectly within the power of the President of the Board of Agriculture, on good cause shown to alter it?—I think it would be very undesirable to have public regulations of that kind frequently changing.

9510. You ask that you should not have them in order not to hamper and discourage the use and investigation of new methods?—Yes.

9511. I point out to you that it is not a necessary consequence of the Board of Agriculture having powers to make regulations that new methods and further investigation would be discouraged?—I think if the Board of Agriculture did fix a test, that that would be adopted, and people would say, "There is the result by the Board of Agriculture's method, and we shall be content with that."

9512. Do you not see that the very fact of a public department like the Board of Agriculture having control, might make it even easier to bring about changes; you do not even see the possibility of that?—No, I do not think so.

9513. You do not think that is likely?—No.

9514. You have recommended in your synopsis that there should be a permanent scientific committee to deal with these and similar matters; how do you anticipate this permanent scientific committee would be any more effective in bringing about these changes than the Board of Agriculture itself?—Because I think scientific questions like those should be dealt with by a purely scientific committee, and one that is continuous in its existence.

9515. You would be liable to chops and changes, would you not?—Yes, quite so; but then I contend that the regulations should not be promulgated as part of the Act of Parliament. My point is that they should not have the same official stamp put upon them that would have to be put upon the recommendations of the Board of Agriculture.

9516. In cases of judicial procedure, where a great deal must really depend upon consistency and uniformity, is it not abstractedly desirable that some central authority, like the Board of Agriculture, or the Local Government Board, should be the means by which these standard tests should be promulgated?—They might still be the means, but the tests should not be promulgated under this sub-section.

9517. Why would it not be promulgated under this sub-section? You see your contemplated committee as constituted, unless fresh legislation were made, would have no statutory powers, and it would have no judicial weight?—I do not think it would require fresh legislation for it.

9518. What value would its dicta have?—It would have weight in this way: Supposing the Committee made certain recommendations which after communication to public analysts, were adopted at the Government Laboratory, those regulations would come into force for all practical purposes, and would have the result of leading to agreement in analysis.

9519. Of course, public analysts have the same power; the Society of Public Analysts could, for instance, appoint such a committee?—They cannot prescribe for the Government Laboratory, and the public analyst has not the time, nor is he paid for devoting a great deal of his time to abstract research. For my part I get very little time to put into that kind of thing. It was the idea of the old Court of Reference that I had there.

9520. Your idea is to set aside some gentlemen—half a dozen it may be—who are to research, whose whole time is given up to questions of this kind?—I do not say their whole time, but a proportion of their time, for which they should receive proper remuneration.

9521-2. Take the case of butter—that they should research upon methods for the determination of the foreign fat in butter, that they should range all over the whole question?—Yes.

9523. And report from time to time to whom?—To the Board of Agriculture if you like, and that their recommendations should be made effective by their adoption in your department and communication to us. You cannot make an Act of Parliament into a chemical text book.

9524. In other words, you are resorting to the old suggestion which came before the Select Committee of the House of Commons, are you not?—Yes, practically. That is a suggestion I had a good deal of sympathy with, of which this Committee is, I believe, a kind of tentative outcome.

9525. In addition to the usual physical and chemical methods for determining small percentages of margarine in butter, you suggest the compulsory addition of some tell-tale substance, and that substance you recommend should be raw sago flour?—I made a specific recommendation, because I thought that would make the matter concrete and easier to discuss.

9526. What advantage do you see in that suggestion over such tell-tale substances as, for example, the German Government and the Belgian Government require in regard to margarine?—Such as sesame oil?

9527. Yes?—I think there would be less objection to mixing sago flour with margarine than to mixing sesame oil with it. Sesame oil is not a very nice tasting oil.

9528. Sesame oil is used very largely in the manufacture of high-class margarine?—I would rather have a definite substance like sago starch to detect than a mere colour reaction such as sesame oil gives, which might be simulated by certain aniline dyes.

9529. Are you aware of the reason which led the German Government, and eventually the Belgian Government, to adopt sesame oil?—No.

9530. You are not aware that they took it because sesame oil was used already in the manufacture of margarine to a large extent?—I did not know that that was the reason why they did it. You can use both. I have no objection whatever to sesame oil being made compulsory, but I think that sago would be less objectionable perhaps. I would like both; it would be two strings to the bow instead of one.

9531. (*Professor Thomson.*) Do you mean objectionable from a popular point of view?—From a manufacturer's point of view principally. I do not think that the public would know much about it one way or the other; but the manufacturers of margarine might raise, and no doubt would raise, objections to mixing any substance of the kind with margarine. Therefore, it should be as harmless and as innocuous as possible.

9532. (*Professor Thorpe.*) With a foreign substance like sago flour they would raise objections unquestionably, but objections were never raised by any manufacturer in the case of sesame oil, because sesame oil is a normal constituent in the manufacture of large quantities of margarine?—It is not invariably present.

9533. In Germany it is invariably present, and in Belgium it is invariably present?—Now it has to be. Then there is also a difficulty in this way, that the colouring matters which are used for butter sometimes contain sesame oil; is that not a fact?

9534. No?—The colouring matter is dissolved in sesame oil.

9535. No?—I thought I saw that in the report of the Preservatives Committee, of which you were a member.

9536. If it were done?—It would be very stupid.

9537. If it were done it was probably stopped?—At any rate, certain of the colouring matters used in butter simulate the reaction of sesame oil, and might be mistaken for it or render its detection more difficult. I have had instances.

9638. Have you?—Yes, in which we got a pink colour with hydrochloric acid.

9639. What have you done with your pink colour?—We have heated it, I think, afterwards.

9540. Do you mean to say that you have confused the pink colour got from certain aniline dyes which were present in the butter with the sesame reaction?—Of course, it can be distinguished, but I should rather not have that uncertainty.

Mr. W. C. Williams.

29 Jan. 1902.

9541. There is no uncertainty?—I do not feel so confident; I would rather not have to heat it; I would prefer to get the reaction in the cold.

9542. (*Mr. Dunn.*) I think you said you objected to the fixing of a standard on the ground that it would legalise adulteration?—I object to the fixing of a low standard, or even of a medium standard, on that ground; of course, a high standard would not have that defect, but would be liable to lead to injustice.

9543. What would you call a low standard that would have that effect; would you say a Reichert-Wollny number of twenty-five?—Twenty-five would permit of that to some extent. I think that was the figure Professor Thorpe was asking me about.

9544. Do you think that at present without the existence of such a standard, a prosecution could be maintained and a conviction would follow where the figure was as high as twenty-five?—If I met with a butter giving that figure in the summer time I think I should not have any hesitation in certifying that that butter was adulterated.

9545. You would be so at present without a regulation of that kind?—The advantage of the present state of affairs is that the uncertainty which exists in the minds of would-be adulterators acts, and is sure to act, more or less as a deterrent. A guilty conscience prevents them doing what they would do if they knew they were going to be judged by a fixed limit.

9546. There is something more terrifying in an unknown limit than in a known limit?—Yes.

9547. There may be something in that, but do you think that analysts at present can do better for the public from the point of view of honesty than they could with even a twenty-five Reichert-Wollny limit?—Yes, but I should prefer no limit. The limit of twenty-five would further have the defect of being only a presumptive limit, strictly speaking, and the rebuttal of the presumption of adulteration would be in many cases very difficult, if not impossible, and I should think most difficult in the cases where the innocence of the vendor was probably the greatest. The rogue generally has his case pretty well prepared.

9548. (*Mr. Hickey.*) How many samples of Irish butter hovering around a Reichert-Wollny number of 21, or from 21 to 25, did you find during 1897-98?—During that year I examined forty-seven samples, and I found 21·6 in one or two out of that forty-seven. They varied from 21 up to 34.

9549. How many of the forty-seven did you get varying according to your method of calculation from 21 to 25, or about how many?—About seven.

9550. Would you have passed those as genuine butters if you had met them in the way of your duty as a public analyst without knowing their origin?—If I did not know their origin, and I got them in the winter I should have had great hesitation in condemning them.

9551. At what time of the year did you get the samples?—In December and January, but if I had got them in October or in April, or in the summer, I should certainly have condemned them. I have recently done such a thing.

9552. As a public analyst, do you usually know where the samples that are sent to you for analysis come from?—I do not usually know that; in exceptional cases I may.

9553. Might you not be guilty of a great act of injustice to the makers of these butters through not knowing their origin and finding these low Reichert-Wollny figures, by certifying that they were adulterated?—Of course, one cannot guard oneself absolutely from that. I can only state what my own opinion is. If I were called as a witness I should make it clear that it was possible to prove that they were genuine; I should take up that position, but I should say that the very great probability was that they were adulterated, and that it would require strict proof that they were genuine before I would accept it.

9554. Would not the local authority almost invariably act on your certificate without making inquiries into the origin of the butter?—I do not know. Of course, the defendant would generally say what the origin was. If proceedings are taken, the prosecution generally does know before the case comes into Court, or, at any rate, when the case comes into Court, what the source of the butter is.

9555. But then the certificate has been given?—The proceedings are instituted, of course, generally in ignorance of the source of the butter.

Mr. Edward William Taylor Jones, F.I.C., called; and Examined.

Mr. E. W. Taylor Jones.

9556. (*Chairman.*) You are an analytical chemist, I believe?—I am Public Analyst for the County of Stafford and the Boroughs of Wolverhampton, Walsall, Kidderminster, and Newcastle-under-Lyme.

9557. How long have you occupied a position as a public analyst?—Twenty-nine years.

9558. Have you given special attention to the analysis of butter?—Necessarily, I have.

9559. Have you, in addition to your official work, done any research work in connection with the determination of the character of butter?—No systematic work that I could put before you now, but I have constantly made a number of experiments and investigations with a view of trying to elucidate the question.

9560. What is the general conclusion that you have arrived at as to the desirability of having a standard for the guidance of courts and analysts under Section 4 of the Sale of Food and Drugs Act?—As an analyst, I should welcome a standard which would facilitate my work, but I must say that in the present state of our knowledge I do not think it is desirable to have an official standard. I think a tacit standard, as given out by the Government chemists to ourselves, and kept really between ourselves, is desirable; but to publish a standard, and make it an official standard to go to every lawyer in the land, and to be generally published, I think is undesirable, simply because we cannot at the present time—at least, I cannot, and I speak for myself only, though I am afraid it applies to more—distinguish between a genuine butter-fat and one that may have been judiciously mixed with, say, 15 or 20 per cent. of foreign fat.

9561. Do you think that the fact of your having agreed among yourselves to a standard could possibly be kept secret in the courts of law?—No, but it could not be brought against us as an official standard. I will illustrate my meaning in this way: At the present moment, if an adulteration of milk by a mixture of milk and separated milk, so as to bring the milk down to what is now known as the official standard, could be proved by the inspector, I am quite convinced that we could not get a conviction in court. The magistrates would not hear it. They would say, "Here is the official standard, and it is up to it." There is another impediment against proceeding in court. I think it is held that a certificate is precedent to a prosecution. How could I give a certificate of adulteration unless it is below the standard at the present time? I could not take that responsibility. Previously an inspector could bring to me a sample; he could say, "This is milk; I wish you to make it a standard for such-and-such a sample that is brought to you; I have good reasons for doing so." I should have no impediment then to accepting that as a standard, of course, the responsibility of proving the standard remaining with the inspector, and I have certified on that basis; but I dare not do it at the present moment.

9562. Do I understand you to mean that in your opinion, although the standard would merely raise a presumption, it would practically carry judicial weight?—It does, undoubtedly. It is as fixed as possible in the eyes of the country magistrates, I assure you, and we cannot get over it.

9563. Then there is the human equation to be dealt with?—There is, indeed. It is a fixed standard "until the contrary is proved." The magistrates hold that if a man says, "I have done nothing at all to my milk or my butter," the contrary is proved. I can mention several cases of milk adulteration coming before a local bench, and very gross cases of adulteration too—gross cases of skimming down to 2·2 per cent. of fat, or something of that kind.

Mr. E. W. Tudor Jones.

20 Jan. 1902.

9564. Is that since the new regulations?—Yes; but the bench say, "The contrary is proved." Those words completely nullify the standard.

9565. Do you mean that placing the onus of proof upon the party charged practically has no effect upon the quality?—We thought it would have, but the magistrates will accept the statement, "We have done nothing to the milk; I can assure you that it is unadulterated." I do not say that a stipendiary magistrate would do it, but the local bench would do it.

9566. (*Professor Thorpe.*) Such a statement as that is no proof?—So I say; but what I have told you is, unfortunately, my experience.

9567. (*Major Craigie.*) In what locality has that taken place?—That took place in Handsworth, near Birmingham.

9568. (*Professor Thorpe.*) If that were taken up to the next higher court, the Petty Sessions, do you mean to say that a decision of that kind would hold if your local authority chose to go forward?—We tried it, because we thought it would not. I said, "For goodness sake, you now can go to the Government analysts and see what they say about it." "Oh, but," the Clerk of the Court said, "the magistrates have found as a fact that the contrary is proved; we do not dispute your analysis, and it is not a question of disputing your analysis; we consider that this poor milk has been naturally produced."

9569. But the Clerk, who is presumably a lawyer, and knows the value of evidence, would not say that the mere assertion of the person, "I have done nothing with the milk," is proved?—Of course, I do not mean to say simply that. They brought the cowman into the box, and two or three other men of that class. I meant to say that there was no real evidence that the milk had not been tampered with.

9570. (*Chairman.*) Perhaps we had better for the moment leave out the human equation, and try to discuss the question as from a purely scientific and professional point of view. Will you give us your opinion as to how far the existing methods of analysis are valid in ascertaining the genuineness or otherwise of butter?—Of course, the Reichert-Wollny—that is, the amount of volatile acids—is the principal test that we go upon. Then there is the iodine absorption, which is dependent upon a totally different thing. I use the Valenta acetic acid test, which is also a valuable test, and then I use the refraction, both by Zeiss and Jean instruments. The specific gravity compared with water at 100° F., I think, is essentially one that was brought out by the Government Laboratory, and a very valuable test it is. Then of course there is the Koettstorfer test—in fact, I do all those constants, not on every sample, but on samples that give a low Reichert-Wollny value, or that give me evidence that they require a thorough investigation.

9571. Do you generally use the Reichert-Wollny test as the standard, and for your own information confirm your Reichert-Wollny number by other tests?—Generally speaking, for a sorting test I used to use the Valenta acetic acid test, making the acetic acid so that it only showed turbidity at 60 degrees with a butter giving a Reichert-Wollny figure of about 26. I also use the Zeiss instrument. If these tests give no suspicion, I do not examine further, except, of course, for water—I mean to say, I do not examine further as to the constitution of the fat itself. But if any suspicion is cast upon the butter-fat by those tests, then I thoroughly examine it by all those tests I have mentioned, and weigh all of them together; also I examine specially for vegetable oils, more especially for sesame oil and cottonseed oil. Cocoanut oil would be disclosed by the tests that I have mentioned to you, as it would yield an extra low Valenta test as compared with the Reichert-Wollny test.

9572. Did you use to commence with the Valenta test?—I used to commence with that.

9573. Do you now begin with the Reichert?—No, I use both. I use the Zeiss and the Valenta test first.

9574. Still?—Yes; but if I have the slightest suspicion, or it is a very important sample, or anything of that sort, I should not neglect to apply the Reichert test at once, even as a sorting test. I do not examine every sample by the Reichert test if it comes out decidedly favourable with those other tests.

9575. If this Committee found it necessary to apply a test, what test do you consider would be the least objectionable?—I do not think they could pass over the Reichert test; I think they must make the volatile acids one consideration. What they should couple with that test I do not know. I would, I think, couple with it the Valenta test and the refraction, either by Zeiss or Jean.

9576. You see no inconvenience in a composite test?—No, it means a little more work. As a matter of fact, I can almost tell from the other tests what the Reichert figure will be unless it turns out very abnormal indeed. I do not mean that I could go and put the figure down but I could tell that it would be about so and so. I know that with my glacial acetic acid made as it is—and I make it so as to give a turbidity temperature of 60 degrees Centigrade, with a Reichert figure of about 25 or 26—I have never found one substantially out; I do not speak within one degree or two of the Centigrade thermometer, but I mean that if it is 59 to 63 you will find them to be about 25 to 26 Reichert.

9577. Whatever test you employ would depend upon the percentage of volatile acids?—I think so; if a test is fixed it must be dependent upon the volatile acids.

9578. (*Professor Thorpe.*) Do you mean directly dependent?—I think that must be stated undoubtedly.

9579. (*Chairman.*) What is your objection in brief to applying an official test now?—Supposing we fix 24 Reichert-Wollny, then a butter with 30 Reichert-Wollny can be let down with 20 per cent. of margarine, and supposing there is nothing distinctive in the margarine we cannot detect it.

9580. Then what is really desired before you would approve of an official test, is some chemical method of accurately determining the amount of foreign fat introduced into butter?—That is so. I am afraid we have not advanced with the knowledge of butter-fat at present to the extent that we can say exactly what is butter-fat and what may be a mixture made to answer the present tests that we have. For instance, I get a genuine butter-fat and mix it with 20 per cent. of margarine, and also with 20 per cent. of cocoa-nut oil, and I make an analysis of those. This table that I have shows that I made all the tests—specific gravity, Koettstorfer, Reichert-Wollny, volatile acids, soluble acids, insoluble acids, iodine absorption, Valenta test, and both refractions; if I run my finger along the second line giving the analysis of the butter with 20 per cent. of margarine, you will see that unfortunately I could not say from any one of those figures that there was margarine in that specimen—I dare not attempt to do that. (*Appendix XXIV.*)

9581. (*Professor Thorpe.*) Not from any one, but could you from the whole of them?—I am afraid not. I should be very glad if I could. The next case is the case of the cocoa-nut oil, and looking at the whole of the figures in that line you can see that something is wrong, as the balance is upset altogether. Of course those figures can be calculated, but they are actually derived from experiments made in the laboratory, and I think they look fairly consistent. The only one test that you would put your finger on was the 6 degrees addition to the Valenta test, making it 66 degrees. I should not like to condemn a butter even on that although my acetic acid test gives genuine butter of 25 or 26 Reichert at 60 degrees; I dare not do it, and I could not do it.

9582. (*Chairman.*) Then we have arrived at this point, that the real desideratum is a test which will accurately determine the amount of foreign fat introduced into any sample—that is the missing link in the chain of analysis?—That is so, unfortunately.

9583. Can you suggest the direction in which such a test should be looked for?—Unfortunately I cannot at present.

9584. Have you yourself conducted any experiments with a view of finding such a test?—I cannot say I have because from very careful consideration I do not see in what direction I am to go at present.

9585. Are you aware whether much experimenting has been done in that direction in the search for the required test?—No, not of my own knowledge.

9586. (*Professor Thorpe.*) To go back to the question of milk, have you actually tested a case in Wolverhampton or in any district for which you are public analyst, in which a man has been seen to adulterate milk by the addition of separated milk, and yet you have not been able to get a conviction?—There was one case in Wolverhampton where the inspector did himself see the milk tampered with. He suspected this, and he hid himself in a railway truck or in an old van. He thought the man was in the habit of tampering with his milk, and so he hid himself, having first sampled the cans of milk before the man got down. He knew the time the man was going down. He then watched, and he saw that the man ladled out a certain portion—the upper portion—of the milk, and put it into a small can. That was a kind of skimming process, the milk having stood there an hour or two. The inspector then took a sample officially after he had seen the man. He said: "I want a sample of your milk." The usual notice was given. Then he brought the samples to me and said: "I wish you, Mr. Jones, to make an analysis of number 1 milk" we will call it, "and take that as your standard for number 2, as I have reason to believe that number 2 has been deprived of some of its cream, and that it was originally equal to number 1." I said: "That is a very difficult thing to do if it is a fairly rich milk. I can compare it truly, and give you the exact percentage that has been removed if the samples are right. I will do so, and I will base my certificate on number 1 sample, but." I said, "I do not know how you will get on in court." I issued a certificate. I forget now what the percentage was, but there was a percentage of fat short in the number 2 sample compared with what there was in number 1 sample, but number 2 was a milk that I must have passed if I had not known about number 1.

9587. That was not quite what I thought had happened; I thought, from what you said, that what had happened was that the inspector had seen the direct addition of separated milk?—No, I hope I did not mislead you; I said, "Suppose an inspector had seen the addition of separated milk" I am afraid I do not know of any method to get into court with it, if the milk so mixed came up to the published standard.

9588. At present I am not aware that there has been any absolute decision, and am curious to know on that point, because it has been pointed out to us as a possible weakness in the regulation, but whether it has actually been tested by a decision I do not know?—How are we to start? Supposing an inspector sees the addition of separated milk, and he brings it to the analyst, and I find, we will say, 3 per cent. of fat and 8·5 per cent. of solids not fat, can I give a certificate?

9589. No?—But a certificate is held in the courts with us to be precedent to a prosecution.

9590. If that be the case, of course it points to some imperfection in the process. If a man is directly seen to sophisticate milk by the addition either of separated milk or of water, you lead us to believe that no action can be taken on that, unless he happens to have added such an amount of separated milk, or such an amount of water, as would bring it below the regulation?—No action can be taken under the Food and Drugs Acts.

9591. How could your legal authority proceed, or have they no right of proceeding in these circumstances?—I do not think they have. A circular came down from the Board of Agriculture to our County Council, and it was put before me. I said: "I do not know how we are to do it." The Board said they had good reasons to believe that milk occasionally was let down with separated milk to the standard, which was a comparatively low one, and would we take such action as to safeguard the public against such a practice. I said to the clerk of the County Council: "I do not know how it is to be done; can you suggest how it is to be done?" It went before the committee of the County Council, and then I think they wrote to the Board of Agriculture and asked them to kindly suggest how we are to do it, as we do not know.

9592. Your legal advisers, you say, have no method of doing it?—That is so; in fact, the clerk went so far as to say that he was quite certain if the milk were up to the official standard we could get no conviction. He told the Council that in my hearing.

9593. To come back to what we are immediately concerned with, you said that if the Government Laboratory would issue their idea of what the limit should be, assuming that the general body of analysts agreed to it——?—And I am sure they would.

9594. Assuming that to be the case, that, for practical purposes, would suffice?—It would be far better, because if the Government Laboratory saw at some future time that it was desirable somewhat to modify their instructions, they could do so, and we should all act in accord.

9595. Why should it not be equally possible for the Board of Agriculture on representations being made either by the Society of Public Analysts or by the Government Laboratory, or by those two bodies jointly, to amend the regulations if they thought fit?—I do not say that they could not amend the regulations, but there would not be such publicity given to the instructions from the Government Laboratory as there would be given to the regulations issued by the Board of Agriculture.

Mr. E. W. Taylor Jones.

29 Jan. 1902.

9596. I do not know that I think much of that argument, if you will excuse me saying so, because it is bound to come out in a court of law. When we worked under a somewhat similar arrangement in regard to milk, prior to the present milk regulations, we had a standard originally—an absurdly low standard, I am willing to admit, as regards the amount of fat in milk—and we gradually modified that standard until we brought it up to a point which was coincident with what the general body of analysts were in the habit of using—I do not say the whole of them, because there were many of them who still worked under the old 2·5 standard; but the difficulty of that condition of things was, that that standard had really no force—it had not even very much force with the magistrates?—That is my very argument in its favour. "Is there not a legal standard for butter?" I say, "No, we have agreed among ourselves"—and also I should have to say probably, "I am instructed by the Government Laboratory that such and such for the time being is the standard, but it is not a legal standard." It is the legal standard in a court of law that upsets us—we cannot go beyond it.

9597. Is it not the fact that in the old condition of things as regards milk analyses, convictions could not be obtained, because the adjudicating magistrate refused to be bound by these standards as they were called? He said they had no force whatever with him. He did not know what the authority was which prescribed them; he did not know anything about the Government Laboratory; he asked something about it, but it did not seem to him to have any official status. Is it not the fact also that in Edinburgh, for example, it was quite impossible to get convictions in the case of milk, because the Sheriffs of Edinburgh did not recognise this understanding between analysts as binding upon them?—It is quite possible and I will grant that it was so if you say so, but I do not know myself what the Edinburgh people did. I know there were difficulties in various parts of the country on that account. I had not a great deal of difficulty.

9598. Therefore how is the difficulty going to be removed in the case of butter when you recommend a condition of things similar to what is past and gone in the case of milk. We should be confronted at once by the sheriffs saying that they did not recognise this kind of understanding between a number of gentlemen who choose to meet in Burlington House or elsewhere and agree; it had no force upon them?—I think that would do less harm than having a standard that may encourage mixing down to that standard without their being liable to be touched.

9599. As the Chairman says, it does not matter what passes between you and me, but it is equally well known to the adulterator whether we choose to lay our heads together in Burlington House, or whether the standard is prescribed by the Board of Agriculture, it is known where the limit is?—Suppose for one moment you took a Reichert-Wollny number of 24 or 25, and a certain number by any other test to accompany it; those two tests I apprehend would not be the whole of the tests, and there would be more or less fear on the mixer's part that by some other test he would be discovered. But he would go for those tests if they were published, and he would say, "If my product conforms to those two particular tests I hold that I am perfectly safe," and he would boldly go before the magistrates. I know it is somewhat weak in argument, but I think it would be a rod held over the gentleman's head if he did not know exactly what we are going on.

9600. I do not think the Board of Agriculture would be so short-sighted as to tie up the analyst to these tests and these alone, and say you must not do anything more. The Board would allow him to get any amount of corroborative evidence that he chose to employ with a view of substantiating his main conclusion, and all that would come out?—This is what I mean: Suppose the sample did come up to the standard as fixed with two tests, or three tests, if you like—whatever tests you like—and suppose that by some other means we were able positively to assert that there was adulteration, I do not think we should be able to get a conviction.

9601. (*Chairman.*) **Take the case of a butter that had a Reichert-Wollny figure of 34—and we have had evidence that such butters do exist?**—They are rare.

9602. Say 33; **we have instances of that?**—Yes, take 33.

9603. Could that be adulterated down to your figure of 24 without its being known to the analyst that it was adulterated?—Unfortunately I show you on the table I have handed in a butter mixed by myself with 20 per cent. of margarine which gives a Reichert-Wollny figure of 25·5. That is a very poor figure, but I do not think you could fix it higher or else you would have to condemn a pretty good lot of butter.

9604. Then the Reichert-Wollny number, under those circumstances, would be of no use?—Not by itself.

9605. I will ask you whether all the other tests would be of any use?—Unfortunately, other tests run the same. This test is only a portion of a measurement; the Reichert test measures a certain distance of the rule and the others measure the rest, and they run generally in the same way. If we get a low Reichert we get high insoluble acids with a high refraction and a high Valenta test. That is our difficulty, unless it should be mixed with cocoa-nut oil, and I do not think they are likely to do that, because that we should find out.

9606. (*Professor Thorpe.*) It is owing to accident, if I may point out, that practically all these tests have been directed substantially to the same characteristics in butter—namely, the glycerides of low molecular weight?—That is so.

9607. It is due to that accident or that coincidence, that is the point?—I do not think it is an accident, is it?

9608. I mean we have rung the changes, but it practically comes to various methods for determining the low molecular weight of glycerides?—That is all, but then I have taken a commercial margarine and I have taken a commercial butter.

9609. You happen to have taken a commercial margarine of rather a high Reichert-Wollny number?—2·6.

9610. I know, but it is not often that margarines have so high a Reichert-Wollny number?—I think that is an average one with me.

9611. Then I should say that has been mixed with a good deal of butter?—That would have about 6 per cent. of butter.

9612. And pretty rich butter I should think?—About 6 per cent. only. It was not oleo-margarine; it was a commercial margarine.

9613. I do not think a man adulterating butter would adulterate butter with margarine and butter; he would start with margarine without added butter; you have taken commercial margarine to which has been added as much butter as the law allows?—I have taken a margarine with 6-10ths of 10 per cent.—that is not a large quantity of butter.

9614. Of course, what we should get in actual practice would be oleo-margarine (without the butter) added to butter?—I do not know. I can assure you that in North Staffordshire there was a case where a woman was in the habit of coming to market with beautifully made fresh butter, and she used to take back from the market a tub of margarine, such as one would buy from a shop in the ordinary way, bringing it back on the next Tuesday, or whatever the market day was, mixed with their own, and made up as fresh butter. Their cows gave a wonderful lot of butter. We got to hear about it, and I may say we got a very severe conviction—£20 both for the mixer and for the seller. That was in the Leek district.

9615. I remember that case, but I had rather in my mind the systematic adulteration on a large scale, we will say, over in Holland?—I do not think this 6 per cent. of butter in the margarine would make any substantial difference to the figures in the second line of my table.

9616. It would make some. However, I will not pursue that?—Margarine gives regularly a Reichert-Wollny number of about 1, does it not?

9617. That is what it usually gives, but this is 2·6?—Yes, and if you take 0·3 from the top, it leaves you 25·2 as the Reichert-Wollny figure—that, taking all the butter away. I am afraid those are stern figures.

9618. (*Professor Thomson.*) Do you see any difficulty in keeping such a standard a secret as compared with the publicity that would be given to a standard made by the Board of Agriculture; must it be kept entirely in the hands of the few gentlemen who make the investigation and fix it?—Probably it would get out to the public that there was some understanding, but so long as there was not a really official standard I do not think it would have the same effect in a court of law; I do not think it would be so rigid. An official standard in a court of law is rigid, and you cannot get past it at all; it is fixed, it is final, and there is no doubt about it. It is no good having the words "until the contrary is proved" or anything of that sort, if the article is over the standard.

9619. In the other case the analyst himself would exercise his own discrimination on the one side or the other?—Yes, and then they can take his opinion for what it is worth. But I say that state of things is better than having an uncertain standard. From an analyst's point of view I should welcome a standard which would facilitate our work very much. But I am simply putting it from a public point of view. I do not think it is desirable at present to have an official standard, and I think we should be better served by the Government laboratory than by any fixed standard being laid down.

9620. (*Major Craigie.*) On that point I would like to get your opinion with reference to the analyst adding any words to his certificate as to his opinion of what has happened to the milk or to the butter. Do you think that it is incompetent for him under the present regulation, supposing he found 3·1 of fats in milk, to add to his certificate: "In my opinion this milk has been deprived of some of its fat"?—He could, but there would be no summons taken out under those circumstances, and no magistrate would convict. Unless there was absolute proof which I could bring forward that it had taken place, I should be very sorry as an analyst to give a certificate of that kind.

9621. But an analyst can add certain words to his actual statement of figures?—Yes.

9622. And, in fact, as a matter of practice he generally does so?—As a matter of practice I do not.

9623. You are aware that it is a practice to add certain words?—Yes.

9624. I gather from your answers to Professor Thomson that you are rather in favour of giving a good deal of discretion to the analyst himself?—No, I prefer a tacit standard, with a certain amount of discretion to the analyst undoubtedly. I think the analyst would be guided by instructions from headquarters—that is, from the Government Laboratory.

9625. You think that the analyst could not make a certificate of the nature that I suggest with any legal effect afterwards?—Not in the case of a milk having 3·1 of fat.

9626. Even if you are of opinion, no matter how, that this figure is not a natural figure for milk, but that it has been reduced?—I am quite sure that it would not be the natural figure, inasmuch as in 90 cases out of 100 in Staffordshire it would be under the mark. Take all my milks of the quarter before last, the September quarter—I do not know the figures for this last quarter—they average 3·5.

9627. Therefore, in the case of a milk showing 3·1, you could make a statement of the sort that I suggest?—I could make such a statement, but would it be a certificate of adulteration?

9628. It is only a certificate of the analyst's opinion?—I do make such statements to my County Council, but we dare not take such cases into court. I am bound to return them as genuine, because they are just above the standard, but, of course, I tell my County Council that although they are above, they are a number of milks that probably have been let down.

9629. Have you any actual case in which a statement of that nature was made and the court refused to act?—I think not. I should not give a certificate, I candidly tell you, of that kind myself unless the inspector came to me and said: "Now, I will take all responsibility; I have seen this thing done." I then should write: "Upon the basis of a sample submitted to me containing 3·8 per cent. of fat, the sample above mentioned has been deprived of so much fat." Then my analysis of the sample being, as you say, 3·1 of fat and so on, I should cast the responsibility of my standard upon the inspector proving that that was the original milk. But you could not do that in ordinary work; you can only do that in very exceptional cases.

9630. (*Chairman.*) To come back for a moment to the case of butter, supposing the Reichert-Wollny figure of 25 were fixed as the official standard, and supposing that a sample of butter showing 25 was given to you, and in it you detected a foreign substance such as sesame oil, if you stated that fact on your certificate, do you mean that the magistrate would not treat that as a case of adulteration?—Of course, I have not had such a case before me, and I cannot possibly say he would not, but I am afraid not.

9631. I take it that your objection to an official standard, or one of your objections, is that the magistrate would disregard the proof that you had put before him that the article was adulterated?—Yes, I do say that.

9632. (*Professor Thorpe.*) I cannot understand it, unless the magistrate is determined to find an excuse to let the man off?—He would say: "Mr. Jones, you have a standard of 25 Reichert-Wollny, this comes up to 25 Reichert-Wollny," and, of course, the defence would make a great deal of that. "It is up to the Government standard, is it not? Why do you say it is adulterated?" I may say: "I got decided evidence of sesame oil"——

9633. "But we are under Section 4, which says that it is not to be a Government standard in that sense, but it is only to be the point at which the Government says a presumption should be raised that the thing is wrong, and we have brought you evidence which hand over hand proves that the presumption is valid." How can they get away from that?—I assure you they do get away from it.

9634. To come back to the case of milk again. You told us you could conceive of no method by which a conviction could be got in the case of an inspector who had seen the sophistication of milk done by means of separated milk; supposing it happened that an inspector had good reason to believe that a certain milk vendor was in the habit of tumbling into his churns a certain amount of separated milk before he went on his walk, and supposing the inspector pounced upon the man, and managed to get two samples of his milk—first a sample of the separated milk and then a sample of the milk which had been tampered with, and he had actually seen the separated milk poured into the other: and supposing that then he got a sample of another consignment alongside it, and he brought the whole three samples to you—those three samples having all been consigned to one man from a certain farmer in the country, and supposing you analysed the separated milk and the milk which he had seen that separated milk poured into, and another churn of the same milk that had not been seen to be tampered with, and supposing you stated all the results to the inspector, do you mean to say that with that evidence in his hands the inspector could not go into court and say that that milk had been tampered with, and so get a conviction?—I say if he came to me and could tell me that he actually saw that thing done, and brought me a sample of the original milk—it does not matter about the separated milk—and I found that the mixed sample which he submitted to me was under the original sample, I could give a certificate to that effect, but I should be loth to do it.

9635. Pardon me, you said it did not matter about the separated milk, but you have got to prove strictly that you saw him adding it, and you can only do that as I suggest?—Very well, I will accept that it was actually added. Then I have to take an artificial standard from the mouth of the inspector, have I not? He has got to prove that. Supposing I have a sample delivered to me in the ordinary way—I only know these samples by A27, A30, and so on; I know nothing specially about them as a rule—and so he would have to give special instructions to me under the circumstances you suggest, and then I should certainty certify accordingly—but I do not believe we should get a conviction.

9636. Supposing even there were no instructions given you, and he brought you three samples labelled A, B, and C, and he was in a position to prove what A was, and that he took A, and you returned him an analysis of A; he was also in a position to prove what B was, and you gave him an analysis of B, and he was also in a position to prove what C was, and you gave him an analysis of C; he had not told you what A, B, and C were, but he could prove what they were. If he could prove to the Court that so much of A had been added to B, but that none of A had been added to C, and that A was, on your showing, separated milk, and that B was a mixture obviously of separated milk and fresh milk—in other words that B was a mixture of C and A?—But by reason of no instructions passed as genuine by me because above the standard.

9637. You expressed no opinion as to its genuineness, however?—That is so.

9638. And you need not have done so; but do you not get over the difficulty by merely giving him the facts?—May I ask you how our returns would come out? I have a great many milks submitted to me under numbers or letters as the case may be, and I make an analysis of them, and I put the bare analyses upon all the certificates I sign in regard to them.

9639. You can do that if you like?—What would be the end of it? The inspector must judge of those figures whether they are right or not.

9640. In a case like that particular case you can give him the facts he wants?—He will have to specially instruct me—that is what I mean.

9641. He might or he might not?—He must specially instruct me, or else it would be treated as genuine separated milk, because he would then have submitted it as a separated milk.

9642. He would not have told you anything about it, would he, in that case?—He ought to; if it were bought as separated milk he must submit it as separated milk.

9643. Assuming that he does, what then?—Then it would be treated as genuine separated milk.

9644. You are making my point; it is, of course, of the essence of this part of the case that you must prove that it was separated milk?—The original milk would be a genuine milk and this mixed milk would be treated as a genuine separated milk, assuming that it did not go below the point of a genuine separated milk.

9645. I am coming back to this; assuming those samples were judiciously taken and the facts were properly given by you I cannot understand where justice would break down, if those facts were laid before the Court?—In practice that could hardly be carried out. There may be one or two cases in which a man may watch, and may be able to give those special instructions, and then we may be able to get the case through; but it is only on special instructions that I could issue a certificate of adulteration. If the mixed sample still happens to be above the standard I cannot, without special instructions give a certificate of adulteration.

9646. (*Mr. Hickey.*) Does not your difficulty of moving the local authority to take steps in a case like that to which Professor Thorpe has referred you, arise when the case is slightly above the limit?—It arises because then we cannot certify that it is adulterated.

9647. You cannot get the local authority to take steps in respect of anything which is slightly above the standard even although you have reason to believe the sample has been adulterated?—I should only be setting up my own view as against the standard fixed by the Government.

9648. Even if you did it on independent information such as Professor Thorpe has referred to?—With special information in one or two cases we may be able to prosecute, and that would be under circumstances where they could watch and see that kind of thing being done, but in practice that is not possible—I mean as a general rule. There was this one case that I have spoken of where a man got in the truck and saw the milk tampered with; but that is the only case that I have met with during my term of office.

9649. (*Professor Thorpe.*) May I remind you how this conversation arose? You said that on the receipt of a communication from the Board of Agriculture, drawing the attention of your local authority to the fact that it was within the knowledge of the Board of Agriculture that the toning down of milk was constantly practised, and asking you to take steps to deal with that, you turned round and said no steps were possible?—And I say so now. I say you will not see them doing it, you cannot get the original milk and you cannot get the wherewithal to certify the adulteration. If I could get the original milk, and if I could trace the milk which had been treated, and I found it poorer than the original milk, I could then say something has been done to it. But I cannot do all this.

9650. That is not exactly in accordance with the evidence which was given to the Milk Standards Committee, and which led to the recommendation which appeared in the Committee's Report, although the form of it was somewhat altered by the Board of Agriculture. We were given to understand by a number of witnesses that it was quite possible for this sort of thing to be checked at many of the local depôts and stations where the milk was received, and cases were, for example, *Mr. E. W. Taylor Jones.*

29 Jan. 1902.

brought under our notice by Dr. Hill, of Birmingham, and cases were also brought before us of milk which had been taken in this way at a number of metropolitan stations, where it was quite possible for the inspectors to pounce down upon a man who was in the very act of doing this kind of thing. Our difficulty now is—and this is what I wanted to get evidence from you upon—to know where it has been proved, by the direct testimony of witnesses who have seen this thing done, how far it is the fact that the law is inoperative, because of the condition precedent to the initiation of proceedings being your certificate. It may be, of course, that if this tampering had been done judiciously the amount of fat would still be above 3 per cent.?—Yes, that may be so.

9651. I want to know whether it is or is not the fact that it is, say, 3·1 that your testimony would overrule the actual ocular demonstration furnished by the witnesses who had seen the act done?—I could not give a certificate of adulteration in regard to a milk which had 3·1 of fat, unless I had special instructions behind me. If the inspector comes to me, and he has seen so-and-so done, and asks me to take so-and-so as a standard. I could then certify; but I could not give a certificate of adulteration on 3·1 unless I knew something of the previous history of the milk.

9652. (*Chairman.*) As I understand the matter the case of butter is wholly different. In the case that we have been considering of milk I can conceive that the analyst may say, "I have nothing to do with the watering of the milk or the addition of separated milk; I did not see it done, and if I said in the certificate that it is adulterated milk, then I am simply giving second-hand evidence." But in the case of butter it seems to me that the Court must rely upon the analyst's certificate, because that is the only source of analysis they can possibly have as to the adulteration or non-adulteration of the butter. Now I put to you again the question: If butter was brought to you that had the official Reichert-Wollny number, or a higher number, but you were able to say as a professional man that it was adulterated with, we will say, sesame oil, would you not on your certificate say that it was adulterated?—If we found distinct evidence on that ground we should, but they would take very good care that there was no sesame oil, and nothing else that we could detect.

9653. I am supposing that there is, not necessarily sesame oil, but some foreign substance which you are able to testify to; do you tell us that if an official standard was fixed that part of your certificate would be ignored by the Court?—Within a certain measure. I still say I think there would be very great difficulty in getting over the fact that it was up to the official standard even supposing I found traces of sesame oil, because there is evidence that genuine butter has shown indications of sesame oil.

9654. (*Professor Thorpe.*) You must not attach too much importance to the Chairman's particular instance—you must rather go for the principle. I will take the question of cocoa-nut oil, cannot a man take a butter faked with margarine and bring it up to our official limits with cocoa-nut oil?—Yes, he could very easily do so.

9655. Nevertheless, you could find that out?—We should find that out.

9656. And yet he would be able to pass those official limits?—That is on the supposition only that you are going to fix it on a Reichert-Wollny number.

9657. In any case, it would pass the official limits?—It would not if you had the iodine absorption test.

9658. Stop a minute; assuming for a moment that we did not put the iodine absorption in, but we put in three other tests, might it not be possible to manufacture a butter in that way which would conform to three tests?—Yes, and I am afraid then you would take the evidence away which we should have for the presence of cocoa-nut oil.

9659. Supposing you know as the result of your work that it was cocoa-nut oil which had done all this, would you return that butter as genuine?—If it conformed to all those tests, and those tests covered variations due to cocoa-nut oil, I should not be able to detect it, I am afraid.

9660. There would be nothing to preclude you, although we may not specify it, using the Hubl iodine absorption method?—But you said you may even bring it normal so far as the iodine test is concerned.

9661. No, I did not; I ruled that out?—Then if you left us with evidence that cocoa-nut oil was there, of course we should certify to it, although it came up to the other tests; but if you cover the question of cocoa-nut oil with your tests, and it does not give evidence of cocoa-nut oil, and if you leave the iodine test out (which is one of the most important of all for cocoa-nut oil, because of its low iodine absorption, then I quite agree I could not certify to the presence of cocoa-nut oil. But are we to examine every sample of butter with all these possible tests? If you fix upon, we will say, two or three tests, could we go beyond those?

9662. You might or might not?—Ought we to do so, I mean?

9663. As I have said already in this room, an analyst when he begins his examination says, "Yes, this is conforming to the regular standard," yet he knows from the character of the butter all along the line that the whole thing is dexterously made up, and he is determined to clinch it, and so he follows it up to the bitter end, and finds it out. This could be done in the case of cocoa-nut oil, could it not?—Yes, and I should certify it under those circumstances, but I think there would be a great deal of difficulty with a standard in getting a conviction even then.

9664. In spite of your direct testimony?—I am afraid my direct testimony would have to go down, and the Government test would be held over me, and it would be said, "This butter conforms to the tests as laid down by the Government, and therefore we disregard yours."

9665. (*Chairman.*) Supposing in one case they did, and supposing it was carried to a higher Court, no one can believe that in a higher Court there would be an utter disregard of absolute demonstration?—No, not if carried to a higher Court.

9666. If it was carried to a higher Court once or twice, do you not think the lower Courts would be affected in their future decisions?—Undoubtedly you may take a case to the King's Bench, but that process is very expensive.

9667. (*Professor Thorpe.*) I think I can recommend you even a simpler procedure than that. If you knew there was cocoa-nut oil, and the Bench was against you, you know perfectly well what your powers are under the Act to get that butter referred, do you not?—Yes.

9668. And you could get it referred?—Yes, we could get it referred undoubtedly, and that, of course, would be the alternative, and the proper alternative. I did not think of it at the moment.

9669. That is what you would do, would you not?—I should undoubtedly do it.

9670. You would send it to the Government laboratory; they would confirm you that there was cocoa-nut oil there, and that the butter had been adulterated with the cocoa-nut oil, then what would the magistrates do?—They would convict then. The Government certificates are absolutely final; there is not the slightest doubt about it, whatever they say you cannot get beyond it.

9671. (*Chairman.*) Then we have got it that behind an official standard you can always fall back upon the Government laboratory, which you say gives the final decision?—Yes, what you say is perfectly true, we could go to the Government laboratory, and we should then, if we were right, get a corroboration.

9672. Does not that make an official standard effective?—I am afraid not; I am afraid there is adulteration that can be practised which neither the Government analyst nor ourselves can detect.

9673. That is another question; we are assuming that adulteration has taken place, and that adulteration is proved?—Then undoubtedly that process would be effective.

9674. Of course, if adulteration cannot be proved there cannot be, and there ought not to be, any conviction; that is obvious?—Yes.

9675. (*Mr. Hickey.*) Assuming that a case such as has been mentioned was brought forward by the local authority, and that it was dismissed by the magistrates, can the local authority appeal that case under the present law to the Court of Quarter Sessions?—I think there is an appeal to the Quarter Sessions only from the defendant if there is a conviction.

9676. Is there any appeal on the part of the prosecutor to the Court of Quarter Sessions?—No.

9677. (*Major Craigie.*) There is no appeal against dismissal?—No.

9678. (*Professor Thomson.*) You could appeal to the Government laboratory?—That would be a case where, having found adulteration, you simply tested the analysis.

9679. (*Mr. Hickey.*) You cannot carry the case further, if the prosecution fails, by appealing to the Quarter Sessions, but the defendant can do it if he is convicted?—Yes, he can. I think we may ask for a case for the Court of King's Bench.

9679*. On a point of law, but not on a question of fact?—No, not on questions of fact.

9680. (*Mr. Dunn.*) You appear to think that the Courts would attach an importance or a significance to the standard that the Government never intended?—I think that they would consider that that standard represented genuine butter beyond all doubt.

9681. Would the Court go so far as to think that it was a licence to the public to reduce genuine products down to the standard?—Not to reduce a product, but as evidence that the product had not been reduced if it came to that figure.

9682. You appear to think, then, that the main object of preventing adulteration may be better attained without a standard than with one?—Generally speaking, I think it could be better attained by a tacit understanding.

9683. You mentioned in an earlier part of your evidence some other optical instrument besides the Zeiss; does that depend on the refraction or on the total reflection?—The oleo refractometer is a comparative instrument, but which do you mean? That by Zeiss or that by Jean? The butter refractometer is the Zeiss and the oleo refractometer is made by Jean.

9684. Do they depend on the same principle?—On pretty nearly the same principle.

9685. (*Professor Thorpe.*) There is one other question I should like to ask you, because I know there is scarcely any public analyst who has had a larger experience than you have had of the working of the Foods and Drugs Act. Assuming that this Committee, as the result of the evidence that you have given us and of similar evidence which we have had and which no doubt we shall have, were to come to the conclusion that the time had not arrived when they could prescribe limits, would not that be an attitude which would be very likely to be misunderstood, and to make the position of matters rather worse than before; in other words, would it not be practically a public declaration of weakness?—Undoubtedly.

9686. And that our chemical methods were insufficient to adequately deal with the question?—Yes, at present.

9687. What would be the position of the prosecution in the Courts of Law if they had to face an admission of that kind made as the result of a public inquiry?—Undoubtedly the admission would be particularly damaging to us. The whole question having been ventilated, it would do us harm by showing our weakness.

9688. I suppose it is the fact that the present methods, imperfect as they are, have done a great deal to check the adulteration of butter?—There is not the slightest doubt about it. There is no difficulty, as you know, with gross adulteration; it is only a question of dealing with the finer adulteration now.

9689. As a matter of public policy and expediency would it not be desirable that this Committee should at least recommend the continuance of the methods as they are, and the system as it is, than practically to have to say, "There is no known method of detecting adulteration in butter"?—It would be pleasanter for the analyst undoubtedly.

9690. I am asking it as a larger question—as a matter of expediency and public policy; our report and evidence would of course instantly be brought up in every police-court where there was a butter prosecution being fought?—Undoubtedly.

9691. And of course all capital possible would be made out of it, and so I am afraid that the last state of things would be worse than the first?—I do not care if you do not go down very low—say to 20; I do not care a bit if you go to 24 or 25 Reichert-Wollny. If you do, you will be taking the responsibility off our shoulders, and also excluding a certain quantity of low-grade butter. We dare not take that responsibility, and I should like you to do it personally from that point of view.

Mr. W. E. Taylor Jones.

20 Jan. 1902.

9692. You have realised the position of matters, and what you are obviously afraid of is inflicting a hardship by the condemnation of a genuine butter which may have what we call a low Reichert-Wollny number, and that may mean that an innocent man may be condemned; on the other hand we have got to take a relatively low number as our standard in order that no injustice shall be done?—Yes.

9693. If we fix a very high Reichert-Wollny number, of course we shall do a large amount of injustice, because we should probably have a great number of genuine butters under it?—Yes.

9694. On the other hand, a low Reichert-Wollny number would allow of a great deal of sophistication, would it not?—Yes.

9695. It is those considerations which apparently have weighed with you in advising that we had better let the thing alone?—Yes.

9696. You say we had better not touch it, that is the advice you tender to the Committee, is it not?—Yes, it is.

9697. What proportion of butters within your experience have these low Reichert-Wollny numbers?—In my own district—I do not know that it is a fair criterion for the general butter trade—I do not get a large number; I may say that I think a Reichert-Wollny figure of 24 would pass 98 per cent. of my butters.

9698. Then an imposition of a 24 Reichert-Wollny number would, in your opinion, do no harm?—In my own district, I do not think it would do much harm.

9699. We are talking of course of our own district, as you can only judge of what you know. In your district no substantial injustice would be done?—No.

9700. What would you put if you were asked to say what is the average Reichert-Wollny figure which butter has all the year round and everywhere?—From 24 to 25, I should think would be the average. I get them down sometimes, but very seldom, as low as 23. They are seldom lower than 24, and I often get them up to 30.

9701. Then your average is a high average?—The average is not high; there are a few of them up as high as 30.

9702. What is your general average?—I have not taken the average out, but I should think about 24.

9703. Would 90 per cent. of the butters you have do you think show a Reichert-Wollny number of 25?—I should think 90 per cent. of my samples would.

9704. That is nine out of every ten butters would?—Yes.

9705. Supposing this Committee took the number 25 as a fair number on which the presumption is to be raised, looking at the thing administratively, as a matter of public expediency, what amount of hardship or injustice would be done?—In my district very little indeed.

9706. How is your district peculiar compared with the rest of England?—I do not know the origin of any of the butters that are submitted to me. They are submitted to me under a number, and I know nothing at all about them, so that I can only speak of the actual results of my examinations.

9707. Your district is the Borough of Wolverhampton, is it not?—Yes, and the whole of the county of Stafford.

9708. Are you likely to be differently situated, we will say from Birmingham?—I should not think so, because we go to Handsworth, which is right up to Birmingham. Large towns do get a different supply, of course. I saw a very abnormal sample of butter which came from Birmingham: that was a German butter, and it only gave a Reichert-Wollny figure of 20.

9709. But that was, as you tell us, a very occasional sample?—Yes; it was about six years ago.

9710. I think you have admitted, if I may say so, that a Reichert-Wollny number of 24 or 25 would at all events cover 90 per cent. of your samples?—I think it would.

9711. And that no substantial injustice would probably be done if it were recommended?—I am certain 24 would not do substantial injustice, and I think 25 would not.

9712. (*Mr. Hickey.*) Is there a good deal of English farmers' butter sold in your district?—There must be, because we are surrounded by farmers.

9713. There would be less foreign butter used in Staffordshire than perhaps in some other parts of the country?—I should think so.

Mr. W. E. Taylor Jones.

29 Jan. 1902.

9714. (*Professor Thorpe.*) You get a large quantity of colonial butter at some times of the year, do you not?—We get colonial butters, but those analyse very well indeed.

9715. Then a Reichert-Wollny number of 25 would not touch those?—No.

9716. (*Mr. Hickey.*) Have English farmers' butters, as a rule, higher Reichert-Wollny numbers than the majority of continental butters?—The colonial butters are higher than the continental butters, and the English farmers' butters, as a rule, would be quite as high or higher than the continental butters. I had one very low farmer's butter that I knew the origin of, but I could never get to the bottom of it. I know that it was not adulterated, but it gave a very abnormal figure; it only gave 3½ per cent. of soluble acids and 90 per cent. of insoluble acids. That occurred twenty-four or twenty-five years ago.

9717. (*Professor Thorpe.*) The cow was probably at the end of her period of lactation, or something of that sort?—There are occasions when you get an abnormal figure, but I should not think that we should condemn farmers' butter even taking a Reichert-Wollny number of 24 once in 100 times.

9718. (*Mr. Hickey.*) If you got all the figures of the tests that you employ as an analyst, except the Reichert-Wollny, at normal points, and if the Reichert-Wollny number was 22 or 23, would you pass such a case as that as a pure butter?—Yes, I am afraid I should; if all the other figures were normal I should detect nothing foreign in it.

SEVENTEENTH DAY.

MEETING HELD AT

ST. STEPHEN'S HOUSE, WESTMINSTER.

Thursday, 30th January, 1902.

PRESENT:

The Right Hon. HORACE CURZON PLUNKETT (*Chairman*).

Professor T. E. THORPE, C.B., LL.D, F.R.S.
Major P. G. CRAIGIE.
Mr. CHRISTOPHER DUNN, J.P.
Professor J. M. THOMSON, LL.D., F.R.S.
Mr. PATRICK HICKEY.

Mr. A. E. BALLEINE, *Secretary.*

Mr. ALBERT RIPLE, called; and Examined.

Mr. A. Riple.

30 Jan. 1902.

9719. (*Chairman.*) Are you a chemist?—No, I am not.

9720. In what capacity do you tender evidence here?—I am the Agricultural Agent of the Norwegian Government in Great Britain.

9721. I believe you do not give evidence as an expert in butter-making?—I should not like to do that.

9722. You have come to give evidence from a trade point of view?—The evidence I intend to give is on the basis of the examinations carried out by the Government Laboratory in Christiania with reference to the composition of the butter-fat.

9723. I think you said that you do not appear by authorisation of your Government?—I have not been asked to appear by the Government; your Committee has asked me to give evidence, and I have informed my Government that I was going to give evidence, so I think there is nothing to say about that.

9724. Do you bring with you any information which has been supplied to you from the Government for the purpose of this inquiry?—Certainly.

9725. Will you tell the Committee what action has been taken by the Government Laboratory at Christiania in order to ascertain the variations in the chemical composition of Norwegian butter?—Since November, 1898, and until the end of 1901, the Norwegian Government Laboratory at Christiania has carried out a series of analytical examinations of genuine Norwegian butter with the view of ascertaining the composition of the butter-fat. For the purpose of these researches samples of butter have been taken every fortnight, sometimes even more frequently, from dairies situated in various parts of the country. In order to be satisfied that the butter experimented upon was genuine, controllers were appointed by the Government, not only to collect the samples, but also to control the make of the butter. It was also the controller's duty to see that nothing but colouring matters and water were added to the cream. After the first kneading of the butter, and before the salting of it, a sample was taken and put up in a bottle supplied by the Government Laboratory, corked and sealed, and after being marked with the necessary information as to the name of the dairy, the date of the sample, etc., the bottle was wrapped well up and forwarded by post direct to the Laboratory. At the same time as the sampling took place, information was collected by the controller regarding the time of calving and the number of newly-calved cows; the date when the cows were put to the pastures in the spring and stabled in the autumn. Further, the health of the cows, the feeding and the condition of the cows, if artificial feeding-stuffs were used, and the state of the weather when the cows were grazing. In short, information about such circumstances which might possibly have influence upon the composition of the butter-fat. On receipt of the samples at the Laboratory, the butter was melted and filtered, and thereupon examined with reference to the refraction, specific gravity, and volatile acids. The refraction was determined by the Zeiss refractometer at a temperature of 45 degrees Celsius. The specific gravity by Koenig's areometer at the boiling point of water, and the Reichert figure contents of volatile acids is given by the quantity cubic centimetre $\frac{1}{10}$th normal alkali solution necessary for the saturation of the volatile acids in 5 grammes of butter-fat. The method employed was the Reichert-Wollny. I may add that from 1899 the iodine figure (Hübl) has also been determined.

9726. I understand that you hand in tables which give the refraction and also the Reichert-Wollny numbers, but you do not propose to hand in the results of the iodine tests?—That is so. They started the iodine tests in 1899, and the figures have only been published for one year; the report for last year has not been published yet.

9727. Can you tell us whether the Reichert-Wollny test was confirmed by any other chemical tests in the Laboratory?—I think they also use the Reichert-Meissl.

9728. (*Professor Thorpe.*) If I understand your evidence aright, there was no direct confirmation of the Reichert-Wollny test thought necessary?—I think not.

9729. (*Chairman.*) In Norway you rely upon that test mainly?—Yes. With reference to the result of these examinations of genuine Norwegian butter the following limits have been found: The specific gravity at 100 degrees Celsius, 0·8636 to 0·8678; the refraction at 45 degrees Celsius (Zeiss), 39·0 to 43·7; Reichert figure, 21·1 to 34·9; and iodine figure 28·8 to 45·1. I place before you the tables showing the Reichert-Wollny figure, and one table showing the refraction from November, 1889, until the end of 1901. In these tables you will see specified for each month the number of dairies, the number of samples, and the minimum, maximum, and mean Reichert-Wollny figures. (*Appendix XXV.*)

9730. Can you connect the high and low figures with any particular conditions in the period of lactation, the feeding of the cows, the temperature, or any other cause?—It will be seen from the tables that the lowest figures for the volatile acids, with a corresponding high refraction, have been found in the butter produced during the months of May, June, July, August, September, and October, which is just the season when the cows are grazing and yielding the richest milk. The weather during this time is, however, somewhat changeable, and sudden changes in the composition of the butter-fat have been noticed as soon as the cows were turned to pastures, and during a spell of cold and wet weather, which has had the effect of lowering the amount of volatile acids and raising the refraction. On the whole, it has, however, been found that the Reichert figure, iodine figure and refraction, with a certain regularity, vary with the season, and to demonstrate this I beg to place before you a table of the Reichert figure, compiled by the Laboratory at Christiania for one of the dairies whose butter has been examined for two years in succession. That is shown on the curves that I have handed in. From these curves it will be seen that from January until the middle of April the volatile acids lie between 30·6 and 33·1; then there is a continual fall until the beginning or middle of June, when the Reichert figure is respectively 21·1 and 22·9, as a consequence of the cows being turned out into the pastures. During the remaining part of June and July there is, with a few and very small variations, an increase, reaching, in the first weeks of August, 1899, 30·1, and in 1900 29·4. From then and during the month of September we have again a slight fall, bringing the Reichert figures down at 25·5 and 25·6, whereupon a marked and almost uninterrupted rise is noticeable for the remaining months of the year, in which the Reichert figure again reaches about 32·5 to 34·5 as a consequence of the cows being stabled. The period of lactation and a certain kind of food may also exercise a greater or lesser influence upon the composition of the butter-fat. In a few cases it has been pointed out by the Laboratory that poor feeding might possibly also have had an effect in causing the low Reichert figure during the spring, but, on the other hand, we have instances where even very poor feeding has not brought the volatile acids below 26·2. When mentioning the feeding, which the Laboratory has described as being poor, I think it is only right to point out that from about the middle of June the feeding has been plentiful, and the condition of the cows good. At all dairies the health of the cows was reported to be good. At the dairies where low figures have been found during the spring and summer, the Laboratury has attributed the changes in the composition of the butter-fat to the cows being turned out to pastures and to cold and wet weather. With reference to the calving season, this does not show any marked influence on the butter from mixed herds, nor can it be expected to show the full effect upon dairy butter, because the calving time is more or less spread over a longer period, so there will always be both newly-calved and stale cows contributing milk to the dairy. I must, however, remark that from 50 per cent. to 75 per cent. of the cows calve during the spring—February, March, April. At all the dairies a higher specific gravity and Reichert figure have been found during the winter than during the summer, notwithstanding the condition of the cows, time of calving, and the weather. I think that must be due to the temperature in the stables. It must here be remembered that during the winter the cows are kept in byres, have very little exercise, and live mostly on hay, while in the summer they have plenty of exercise, and are principally or exclusively fed on grass. However, whatever the cause may be, we have also in Norway found that the analytical figures lie considerably beyond those which were formerly supposed to be the limits for genuine butter, and we would not declare any sample to be adulterated solely according to analytical figures ranging within the limits found in authenticated genuine butter.

Mr. A. Ripla.

30 Jan. 1902.

9731. What limits are those?—The limits found by the Laboratory during their researches.

9732. Then you mean you would not consider any butter to be presumptively impure if it had a Reichert-Wollny figure above 21?—That is so. We are prepared even to find lower figures, as they also have done in Denmark, for instance, where they have found lower figures than 21·8. These researches have only gone on for, say, three years, and we might find lower limits still.

9733. What exactly is the law in Norway as regards the adulteration of butter?—According to the old Margarine Act of 1886 butter showing a lower quantity of volatile acids than 12·25 c.c., which perhaps is a little lower than a Reichert-Wollny figure of 25, was considered to be adulterated.

9734. (*Professor Thorpe.*) Your first figure is the Reichert-Meissl number?—Yes.

9735. The sole difference between the Wollny number and the Meissl number is that Meissl originally took 2½ grammes instead of 5, but you cannot multiply a Meissl number by 2 in order to convert it into a Wollny number, because the Wollny number is obtained by distilling the butter fats into a definite volume of the distillate in a definite time and with the Meissl method they go on adding water and distilling over, so that as a rule double the Meissl number would give a rather larger Wollny number?—I do not think there is any considerable difference between the Wollny and the Meissl numbers. According to the information that I have here from the principal analyst in Christiania they have found 30·9 and 30·6 with an average of 30·8 according to the Reichert-Meissl, and according to the Reichert-Wollny they have found 30·1 and 30·4, with an average of 30·3, so that the difference between the two has only been 0·5. In another case the average of four examinations gave 29·5 as against 29·3.

9736. That may be perfectly true of those particular samples, but it is the fact nevertheless that the numbers occasionally are very divergent, because the caprylic and caproic acids only go over with difficulty, and a portion of the acids solidify. As a matter of fact, by the Meissl method they are all stirred up together and the titration is done all together; but in the Wollny method the solid acids are filtered off and they are not neutralised, and it is quite an accident when they agree. I have seen variation of three or four cubic centimetres between the two methods. It depends on the nature of the butter?—I was not aware that there were such wide variations.

9737. (*Chairman.*) You were telling us what was the procedure under the Margarine Act of 1886 in the case of suspected butters?—Yes. According to that Act, if butter contained something less than 25 cubic centimetres it was to be considered adulterated; but I do not know of any cases where that law has been carried into effect, because further inquiries have shown that the butters which were challenged were quite genuine.

9738. (*Professor Thorpe.*) In other words, the presumption was raised at 25, but it was rebutted by subsequent inquiry?—Yes.

9739. (*Chairman.*) Is there any provision in your law prohibiting the admixture of butter with margarine or margarine with butter?—The Norwegian Storthing has just passed a new margarine law, and according to that it is prohibited to make butter and margarine in the same building; in the building where butter or cheese is produced, collected or packed, the production of margarine must not take place. There is also a special section in the Act giving the police and the dairy inspectors a right to go into every dairy or warehouse where butter or margarine is kept, and to take samples.

9740. May the admixture of margarine with butter or of butter with margarine be carried on?—In the margarine factories they use butter, and that is allowed; but it is illegal to adulterate butter by the addition of margarine.

Mr. A. Riple.

30 Jan. 1902.

9741. Is there any restriction as to the quantity of butter that may be added to margarine in order to make what is known as a margarine mixture?—I do not think there is.

9742. Can you tell us what is the total production of butter in Norway, and what proportion of the total production is exported?—We have not any statistics showing exactly the total production of butter in Norway, but I can give you the quantity exported. It varies, of course, as our butter production depends very much upon our hay crop, because our cows are mostly fed on hay. In 1899, according to the English statistics, we exported 30,965 cwts., but in 1900 we only exported 26,085 cwts. In 1901 the exports amounted to 26,341 cwts.

9743. Did most of that butter come to this country? —That is the import into Great Britain.

9744. (*Professor Thorpe.*) Those figures would show that the importation of butter from Norway into this country is steadily declining?—It has been, and that is due to the short hay crop we had in 1899 and 1900.

9745. (*Chairman.*) What would be the effect upon the Norwegian butter trade if a Reichert-Wollny number of 25 were imposed here?—According to the figures I have, we should not be able to export to Great Britain the same quantity that we have done during the summer months, because then we have figures below 25. I think it is rather strange that we should see these low volatile acids, because the milk is very fat, and the percentage of fat is higher during the summer than during the winter and spring months. I think that is due to the cow going out on the pastures. We have very good pastures, but as you have seen from the results in the laboratory at Christiania, and the conclusions they have drawn, they think that these low volatile acids are due to the cold and wet weather. It must be remembered that our country is a very hilly country, and that we have many farms situated several hundred feet above the sea. Of course, the temperature will vary very much there, but at the same time I do not think there is any place where finer butter is produced than we get on these highly-situated farms on account of the splendid pastures they have there.

9746. I suppose it would be difficult for the farmers very much to change their methods in the direction of giving better feeding and housing their cattle for a longer period?—Certainly it would, and I am not quite sure whether any difference of feeding would make any alteration in the Reichert-Wollny figure.

9747. Not if combined with less exposure?—No, because in other countries where similar experiments have been carried on, for instance, in Denmark, it has been ascertained that an addition of cake or corn does not affect the quantity of volatile acids as long as the cows are out, but it seems to have an effect when they are put to the stables. I think this is more due to the temperature than to the food.

9748. (*Professor Thorpe.*) The numbers which you have presented to us do not give us perhaps all the information that you may have. For the Reichert-Wollny numbers you have given us extremes of 21·1 up to 34·9, but we have no information—at least, I have not—as to the frequency with which those extremes occur. Can you tell me the total number of analyses on which these numbers are based?—No, I do not think I can. I know the laboratory at Christiania is working out more detailed statistics, and also a table to show in which months these variations most frequently have taken place.

9749. As the Chairman points out to me, if we may deduce anything from these numbers, it cannot be very often that any butter below 25 would occur?—I have Dr. Werenskiold's report for 1899 here, in which he gives a sort of abstract of what he has found. I find here at the Ostens dairy on the 17th June there was a Reichert figure of 21·4, and at the Bondalens dairy on the 13th June the figure found was 21·1, on the 23rd June 21·4, and on the 2nd June, 22. I could not say how many instances he has found of these low figures.

9750. The weight of these figures in the mind of the Committee would be very different if it were pointed out that only one sample in 1,000, say, showed a figure of 21·1, because then it would be scarcely a practical matter in view of the other evidence we have received, and it would not be worth giving much consideration to?—That would be so. Of course, I have only had these reports to go upon. No doubt they have taken more analyses than these reports show, and apparently they have given only a few of the figures where the butter seemed to undergo most changes.

9751. If I understand your tables rightly, they mean that during the whole course of the time from November, 1898, to December, 1901, some 20 different dairies were under inspection?—The first year they started with 9, the second year they started with six fresh ones and three of the old ones, and so in the third year they had six fresh ones again and three from the preceding year.

9752. How many dairies have been under observation during the whole time?—There have been 21 different dairies.

9753. Has any one dairy been under observation during the whole time?—I do not think so. I do not think, as far as my information goes, that any single dairy has been under observation for more than two years.

9754. How many cows on the average would there be in each dairy?—We have not got any statistics with reference to that.

9755. Was not that information as to how many cows were concerned in the production of the sample of butter communicated with the sample?—I do not think so; they were only asked to state how many cows were supposed to calve at a certain time, and they were not asked how many cows belonged to each dairy.

9756. What kind of people produce butter in Norway? Are they large or small farmers?—The dairies vary very much, but they are mostly small dairies.

9757. What would be the average number of cows that a small farmer would have?—I think more than half of the dairies that export their butter do not produce more than 2cwts. a week—that is, two casks. The larger dairies produce from 30 to 35 casks a week, but most of the dairies are small ones, and I do not think the average production in the western district, where the greater part of the exporting dairies are, is more than two casks ,or two cwts. a week.

9758. How do they get their butter to the ports; do they send it direct themselves, or are there persons who collect it?—The dairy exports the butter direct; the only middleman they use is, say, a forwarding agent in the shipping port.

9759. Is there no factory system in Norway?—No.

9760. Each farmer trades directly then through an agent?—Each dairy does. When the butter is made there it is sent direct from the dairy to the ship. It has sometimes to go by the local steamers, and sometimes it is carried by road. As a rule it arrives at the last moment, just in time to catch the steamer going to England, so it is not stored as a rule. The casks are, of course, in proper and good condition, sacking is put around them, and everything is marked, and made all right. I think many dairies do not use any shipping agent at all, but consign it direct.

9761. If I understand it rightly, the system is this: From the north to the south of Norway the farmer sends the kegs of butter to the local port, where the local steamer running up and down the coast calls?—Yes, the dairy does.

9762. The local steamer takes it to Bergen, or where? —The local steamers take it to Drontheim, Christiansund, Aalesund, Molde and Bergen, where the mail that goes to England calls; and from these ports it is sent direct to England.

9763. Is that butter handled by anybody before shipping; is it repacked or in any way treated?—No, never.

9764. Then it comes to our ports in the original packages in which the farmers placed it?—Yes, it does.

9765. How long a time would elapse before that butter reaches us by such a system as that?—From two to five days.

9766. Is margarine made in Norway?—Yes.

9767. Where is it mainly made?—It is made both on the eastern side and on the west coast.

9768. It is made on the coast then?—Yes.

9769. Do you know how many manufactories of margarine there are in Norway?—I could not say now.

9770. Is the manufacture of margarine a growing industry in Norway?—I am without accurate information.

9771. Have you any idea what is the amount of margarine made in Norway?—No, I have not.

9772. Is margarine an article of general consumption in Norway?—I think it is being more and more used.

9773. It, of course, is carried by these same local steamers up and down the coast, too?—That may happen.

9774. I want to get some information as to the facilities a person would have who might desire to mix margarine with butter; would the margarine be readily available?—I do not think there is any facility for that.

9775. Why would there be no facility?—I do not see how that man could get control of the butter destined for export after it has left the dairy.

9776. I am speaking of the farmer—the dairyman who makes up the butter?—According to the margarine law, he is not allowed to do that sort of thing; butter and margarine cannot be produced in the same dairy, nor is any margarine allowed to be kept in any dairy.

9777. You tell me that these are comparatively small farmers?—Yes, that is so.

9778. Considering what you say as to the way in which margarine is distributed up and down the coast, what is to prevent a farmer buying a small quantity of margarine and working it into the butter?—Butter is not produced for export in the single farms—they cooperate in our country. There is a special dairy built for the production of butter, and in that dairy they cannot handle any margarine.

9779. I rather gathered that each farmer made his own butter, and I asked you if there was anything akin to the factory system?—Butter is produced on cooperative principles just as it is with the Danes.

9780. Does the farmer bring his cream or his milk to the dairy?—The farmers bring the milk to the dairy, where it is churned and put into casks, and sent direct here.

9781. That is quite another thing, of course; then the butter may be the product of a great many farms?—Yes, sometimes it is. A dairy sometimes makes up 30 or 35 casks a week, but most of the dairies only make a cask or two casks a week. That shows how small the farms are.

9782. Then the co-operative dairies only turn out small quantities?—Yes.

9783. Are the dairies mentioned in your tables cooperative dairies?—Yes.

9784. They are not the individual dairies of farmers?—No, they are not.

9785. It is important to know that. Of course, under that system all butter so produced would much more represent the average output of Norway than if it were produced from single farmers' dairies?—That is so.

9786. That system allows of a more general averaging of the whole thing?—Yes, it does.

9787. Why, have you specially selected the particular dairy for which you have given us the curves; is it a co-operative dairy or a farm?—It is a cooperative dairy.

9788. Can you give us any information as to the number of individual farms which may have contributed to this dairy?—No, I cannot.

9789. Is it a large place?—No, it is not; I should think Bondalens is a dairy producing only a couple of casks a week, but I could not say for certain.

9790. Whereabouts is it?—It is in Sondmore, in the same district as Aalesund.

9791. May I say it is in central Norway?—We may say it is in the western part of Norway.

9792. Would it be in a district where the farms are very small?—Yes, they are very small there.

9792*. And where the pasture presumably is not as rich as in other parts?—I would not say that. As a rule the pastures are very good in Norway.

Mr. A. Riple.

30 Jan. 1902.

9793. These tables show us that whilst the cows are stabled the Reichert-Wollny number is relatively high?—That is so.

9794. In the middle of April the cows are apparently turned out to pasture?—Yes, as a rule they turn the cows out, say from the middle of May or the beginning of June.

9795. Apparently there is a sudden drop even before that time in the case of this particular Bondalen's Dairy?—Yes.

9796. I infer from that that the cows, or a good many of them, which have contributed to that butter, have already been turned out on the pasture?—In Mr. Werenskiold's Report for 1899, he says the cows were turned out about the middle of May, and the calving took place from December to April. The drop therefore in April may be due to the calving.

9797. Because some of the cows may have calved then?—Yes.

9798. Anyhow you are quite right; there is a very sudden drop about the middle of May; then the curve begins to run down very rapidly. When would the snows disappear in Norway?—The snow seldom lies in the valleys after February and March. Snow falls very irregularly, and does not cover the land throughout the winter. The winter in Western Norway is more characteristic for its proportionately large number of frosty days.

9799. A great deal of the snow would still be lying about?—Yes, on the mountain pastures.

9800. A cow, I presume, would have some difficulty in finding its sustenance if turned out in the middle of April?—That is the reason why they do not turn the cows out so early as April.

9801. Would it have much difficulty in finding sustenance if it was turned out in the first weeks of May?—It depends; we have sometimes a late spring, as we call it.

9802. Then frequently there would be, would there not, a good deal of snow about in the middle of May?—No, I would not say that.

9803. Of course the herbage would be scanty, and you would have frequent wet, I presume, about that time?—The herbage might be scanty, but the weather is not wet as a rule.

9804. The general conditions would be inclement?—Yes.

9805. And the pasture would not be particularly rich for some time?—That may be in certain places.

9806. That condition of things, according to your curve, would appear to go on until about the middle of June?—Yes.

9807. Then there is a very sudden jump up. I suppose when you get your summer the snow is melted, and the grass grows rapidly, and the conditions are more favourable?—Yes.

9808. We see the immediate effect upon the Reichert-Wollny number, though of course it wobbles about a little, but still the general trend of the curve shows that the cows rapidly recover, so far as the Reichert-Wollny number is concerned?—Yes.

9809. How do you account for the drop again in the early autumn?—I attribute that to the cold and the wet weather.

9810. That again begins to set in then?—Yes.

9811. You have a very short summer obviously?—Yes, we have.

9812. Apparently it only lasts about six weeks?—You may say that it lasts for nearly four months in Western Norway. Sometimes in the middle of May we may have fine weather, but June, July, and August are the three best months.

9813. After that period it appears to be rainy again?—Yes, rain mostly falls during the autumn and early winter.

9814. The cows are kept out till September, I presume?—Yes, and October.

9815. Then when this minimum is arrived at, largely in consequence of the growing inclemency of the season, the wet and so forth, the cows are put into the stable again?—Yes.

Mr A. Riple.

30 Jan. 1902.

9816. I presume that the rapid rise which we then see up to the end of December is due to the stabling, and perhaps the richer food?—I think it is due to the stabling.

9817. In general this accords with what has been observed in Friesland; do you know that?—Yes, I know a little about it.

9818. And it also accords, as you tell us, with what you believe to have been observed in Denmark?—Yes.

9819. You have said that the cows have exercise, but I suppose that they take that exercise in order to search for their food?—Yes, they go loose; we do not tie them as they do in Denmark.

9820. A cow has to do a great deal of walking about to pick up something, especially in the early and late periods?—Yes, sometimes they go very far away.

9821. Do you know anything as to the influence of exercise in affecting the Reichert-Wollny number?—No, I do not.

9822. You are not aware, for example, that if a cow has been worried and chased around a field, the amount of volatile acids drops in her butter?—I have seen something about it.

9823. I suppose a good deal of walking about of any kind would affect the proportion of volatile acids, would it not?—I do not know whether that is due to the exercise, or whether it is due to the weather; I could not say which, and I do not think it has been ascertained.

9824. At any rate, warmth and indolence apparently contribute to it when she is stabled, for a cow cannot take much exercise in the stable?—In that case I think it is the effect of the heat.

9825. And may we say that it is also due to the absence of muscular movement on her part?—Yes, probably.

9826. Do you know that if cows are teased and worried with flies, even although the temperature may be very hot, the Reichert-Wollny number of their butter is affected?—I am not aware of that.

9827. (*Mr. Hickey.*) Could you furnish the Committee with the number of samples that showed a Reichert Wollny number varying from 21·1 up to 25?—I could not at present do that, as I have not got the statistics, but I could certainly get that information from the Laboratory.

9828. Could you send that information to the Committee?—Yes, certainly I will.*

9829. (*Mr. Dunn.*) At what time of the year did you say the cattle are turned out in Norway?—From the middle of May or the end of May and the beginning of June. It depends upon the weather, and the conditions of the pastures.

9830. When are they housed again?—At the end of September, say, or in October.

9831. Does that apply to the extreme north and the extreme south of Norway?—Yes, I should think it would. The Report of the Laboratory says that the cows are put upon the pastures in the latter part of May and the first part of June, and that they are stabled at the end of September and October.

9832. Is much butter exported from the extreme north of Norway?—Not from the extreme north of the country. All the exporting dairies are situate on the west coast, say from Drontheim downwards.

9833. There is very little of east and west in Norway, and there is a great deal more of north and south, if I may so put it?—Yes, Norway is about 1,100 miles long, and from 60 miles wide in the north to 250 in the south.

9834. How long has the Government been observing the fluctuations in the volatile acids?—From November, 1898.

9835. (*Professor Thorpe.*) Do you adopt any system of ear-marking margarine in Norway; are the manufacturers, for instance, compelled to put anything into it to identify it as margarine, as they are in Germany?—I do not understand the term "earmarking."

9836. In Germany they are compelled to put 11 per cent. of sesame oil into the margarine; is there anything of the kind done in Norway?—I could not say. The Act says that the manufacturers may not add other preservatives than salt to butter and margarine.

9837. That is a question of preservatives. I have asked this question because when I had the pleasure of seeing the late Dr. Werenskiold, he told me there was a proposition before the Norwegian Storthing to use phenolphthalein as a re-agent to mark margarine, and that he had made experiments himself as to the amount of phenolphthalein that he could eat with impunity. I believe that he pressed that suggestion of his very strongly upon the legislature; do you know if any action followed from that?—No, I do not know of any.

9838. Could you get us any information as to whether anything is done to earmark margarine in Norway, so as to identify it by putting something in of the nature of starch or sesame oil, or something else which would characterise it?—I have got the new Margarine Act here. The police and the dairy inspectors have the right to go into the buildings to see what is going on, and what sort of substances are used, and manufacturers must give every explanation that is required by these inspectors and by the police.

9839. But there is nothing by which margarine may be identified if it were mixed with butter?—I do not know of anything.

9840. The object of the German law was to allow of the identification of margarine in butter; sesame oil is a substance which may be readily detected by chemical analysis, and therefore it serves to identify the margarine, but there is no provision of that kind in your law?—I cannot find any at present.

9841. Does the margarine law explicitly state that mixtures of certain relative proportions of butter and margarine may be made in any quantities?—I can only say that it was proposed that 100 parts of margarine should not contain more than 15 parts of butter-fat, but that was not passed by the legislature. They did not fix the quantity of butter-fat which could be allowed to be added to margarine.

9842. Then these mixtures of margarine with butter are made in Norway?—They do add a little butter to the margarine.

9843. So do we; we are allowed to add up to 10 per cent.?—I do not think as a rule you will find more in Norwegian margarine than 10 per cent.

9843*. A manufacturer may make a margarine containing 10 per cent. of butter, and may mix it with butter if he chooses?—I think he is allowed to do that, but such mixture must be marked, sold, or exported under the name of margarine.

9844. Do these margarine manufacturers send their margarine to England?—There is a small export of margarine to England.

9845. Are they also butter shippers?—No.

9846. They are only margarine shippers?—Yes.

9847. (*Major Craigie.*) With reference to the export of margarine from Norway, have you any figures from the Norwegian trade accounts similar to the figures you have given of the export of butter from Norway?—According to the statistics published in Great Britain for 1900 there was imported from Norway in that year 8,430 cwts. of margarine.

9848. That is what we have received in this country; but my question was rather, what are the total exports from Norway? There is an export from Norway into Denmark, I think?—Yes, that is quite right, but I have not the figures.

9849. But you are aware that there is an export to other countries as well as to the United Kingdom?—Yes.

9850. Does Norwegian margarine go to other countries than Denmark?—We export margarine to most of the European countries.

9851. Have you the export to the United Kingdom in other years besides the year 1900, which I think you quoted just now?—I have not got the figures here, but I do not think they vary much.

9852. Then about 8,000 cwts. of margarine a year is exported from Norway to Great Britain?—Yes.

9853. Might I refer for a moment to your answer to the Chairman on the subject of the export of butter into Great Britain; you gave the English figures, and I am not quite certain whether I caught you correctly, but I think you drew the conclusion that there was a steady diminution in the exports of butter from Norway to Great Britain?—There have been during the last few years, and I said that it was principally due to the short hay crop we have had in 1899 and 1900. Last year we had a very good hay crop, and so the quantity of butter exported will very likely be increased a little. The decrease I have noticed is, I think, mostly due to the fact that we had a shortage in the hay crop for two or three years in succession.

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* Mr. Riple subsequently sent the following information: ". . . of the 657 samples, 29, or 4·4 per cent., were found to be below the Reichert figure of 25."

9854. Has there been any change in the export of butter to other countries from Norway?—What we export to other countries than the United Kingdom is almost nil.

9855. It is quite a small matter?—Only two or three tons a year.

9856. You have not carried your comparison back as far as the year 1896, have you?—No.

9857. If you were to do that you would find that in that year Norway only sent to Great Britain 17,000 cwt., whereas in 1897 she sent as much as 28,000 cwt; so that the decline, such as it is, in the last two or three years is only a decline from a very much higher figure than previously prevailed?—That is so.

9858. Are you aware that there was a very great increase in the Norwegian exports of butter about the years 1896 and 1897?—Yes, that was so.

9859. Was that stimulus which was given to the trade due to any particular weather, or to any other circumstances?—The dairy industry is comparatively new in our country, and more and more farmers are now co-operating to build dairies, so it is a growing industry; but it is so dependent, as I have said, upon the hay crop that if they have not sufficient hay they prefer to go to the butcher with the cow; they do not keep so many cows then. The growth of this industry is shown by the following figures:—The dairies in 1890 numbered 323, whilst there were 671 in 1897, and 777 in 1901.

9860. (*Professor Thorpe.*) Does the butter from Norway tend to come to England at any definite period, or is it spread uniformly over the year?—It is spread over the year, but most of the butter comes in the spring.

9861. Would you say from now onwards?—The highest months are January, February, March, and April, and during the summer it is very small.

9862. When does the minimum supply of butter come from Norway to England?—During the summer, I think, June, July, and August.

9863. You export the smallest quantity then?—Yes, and in September. We used formerly to import a fair quantity of butter into Norway, but our production has been on the increase all the time, and we are able now to produce sufficient for the home consumption. There is still a small import into Christiania during the summer months.

9864. That means that precisely at that period of the year, when your Reichert-Wollny numbers are lowest, then the economic conditions of Norway are such that your butter remains at home?—It is a question of the price. It pays them to sell it at home then, and the production is not large enough also to export a similar quantity as in the winter months.

9865. I quite understand the cause of it, but it is the fact that it so happens that just at that period of the year when those low Reichert-Wollny numbers are most prevalent, the greater part of your butter remains in Norway?—Yes.

9866. So that should we impose a Reichert-Wollny limit, for example, that would not unduly press Norway, because she would be able to comply with that limit at the very time that she sends us the butter?—No, I would not say that, and it would not be fair to say that.

9867. I think it follows from what you have told us?—No.

9868. (*Mr. Hickey.*) Is the production of your butter likely to increase?—It is.

9869. Then you might have to export more freely in the summer?—Yes. There is another thing to be considered. It is much easier for the dairies situated on the western coast to export to Great Britain than to send their produce to Christiania, for instance; the passage even takes a shorter time, and the freight is not much heavier; so, as a rule, all the dairies on the western part consign all their produce to Great Britain all the year round. The necessity of regular consignments is also urged by the British importers.

Mr. A. Riple.

30 Jan. 1902.

9870. (*Professor Thorpe.*) Of course, they will go where they get the best price, and though you are not able to supply Christiania all the year round regularly, naturally if the price is good your first consideration will be your home market?—That is so, but the tendency in Christiania is for the price to come down, on account of the production being on the increase; so we must have the market here.

9871. (*Major Craigie.*) Do you import butter into Norway?—Very little now. The imports have decreased from about 1,100 tons in 1896 to 238 tons in 1900.

9872. Is it Colonial butter that you do import?—No.

9873. Where do you get your butter from when you do import?—From Sweden, Denmark, and a few other countries.

9874. Have you a return of the number of cows in Norway at the present time, or have you any figures later than those of the year 1890? I had rather an impression that a census of the cattle in Norway was taken in the year 1900?—That is quite right; I know there are some 900,000, but I have not got the exact figures with me.

9875. In our returns we have not got the number of cows in Norway for any later date than 1890, but when I was in Norway myself in 1899, I understood from the Director of Statistics at Christiania that the return was to be taken again in the year 1900; therefore I am asking you whether you can supply the Committee with later figures? Something curious happened about the number of cows in Norway in the year 1890. Then Norway showed—in this differing from almost all other countries—a decrease in the number of cows as compared with the previous census taken in 1875; and I want to know whether during the last ten years there has been an increase in the number of cows in Norway?—I am sorry that I have not got those figures with me, but I could certainly supply you with them. I remember having seen some such figures recently.

9876. If you can get those figures, perhaps they could be added to the information you have been good enough to say you will send to the Committee?—Yes.*

9877. Are you aware of the fact that I put to you just now that the number of cows in Norway in the year 1890 was only 707,000, whereas 15 years before there were 742,000, so there was a falling off in the number?—I know there are some 900,000 now, according to the last census, but I could not give you the exact figure.

9878. That would mean that there has been a considerable increase in the number of cows in Norway in recent years?—Yes.

9879. So the fact of the export of butter having diminished is not due to a falling off in the number of cows?—No.

9880. But probably to a greater consumption of butter in Norway itself?—Partly to that.

9881. Partly to the larger number of tourists and visitors in summer, both German and English?—Yes.

9882. You have many more tourists than you used to have?—Yes. Then they also make cheese in the summer time. The farmers have, as a rule, what we call out-farms or saeter farms, and there they keep the cows during the summer time. These out-farms are situated too far away from the home farms, so that it would not be possible for them to bring the fresh milk down to the home farms or dairies and have it made into butter there. They therefore keep it on the out-farms and make cheese and what we call saeter butter; but that butter is not exported, and is made only for the home consumption.

9883. Is the butter which is exported from Norway salted to any extent?—Yes.

9884. To what extent is salt added?—I should think between two and three per cent. of salt is added.

9885. As much as that?—Yes.

9886. More salt than is put into the Danish butter?—No, it is made on the same principle as Danish butter,

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* Mr. Riple subsequently informed the Secretary that the number of cows in Norway in 1900, according to the census, was 948,736.

Mr. A. Ryde.

30 Jan. 1902.

and I do not think there is much difference in the quantity of salt added to it.

9887. (*Professor Thomson.*) I am sorry that I was unable to hear the earlier part of your evidence; have you in the course of it expressed a decided objection to fixing any Reichert-Wollny number?—I do not think it is possible to arrive at a reliable standard.

9888. You think it is not possible to fix a standard?—Yes, it would be very difficult.

9889. (*Major Craigie.*) I understand you to say that you think an injury would be done to the Norwegian trade by fixing any Reichert-Wollny number?—Yes.

9890. Have you anything to add to the answers you have given on the subject of securing the genuineness of Norwegian butter?—Yes. In addition to the fact that the law prohibits the making of butter and margarine in the same building, whenever samples are taken here of Norwegian butter, the control sample is sent by me to the Government Laboratory, in Christiania, for examination, and if the chemist at the laboratory finds it of a suspicious character, he enquires. We can always trace the maker of the butter, because it is shipped direct from the dairy to Great Britain, and we know from the mark on it which dairy has made the butter. They send an inspector up there to take a sample out of the churn, and that sample is analysed, and in case they find it to agree with the suspected sample (of course, they may find it not to agree), they think they have proved that the butter sampled is all right. They are, of course, perfectly willing at the laboratory to do anything in order to give whatever guarantee they can as to the genuineness of the butter. I think the new Margarine Act is a step in that direction to assure the consumers that the butter they get is genuine.

9891. (*Mr. Dunn.*) Does the law prevent the keeping of margarine in the dairies?—Yes.

9892. (*Mr. Hickey.*) Have any prosecutions taken place in England respecting the purity of Norwegian butter?—No prosecutions have taken place, but we had one case in 1900. There was a sample then which the Government Laboratory said was suspected, or raised a presumption that it was adulterated.

9893. Was that taken at the port of entry?—Yes.

9894. Did any prosecution result?—No, the Customs dropped the case; we were prepared to prove that it was genuine.

Mr. HARALD FABER, F.I.C., recalled; and further Examined.

Mr. H. Faber

9895. (*Chairman.*) Since you were good enough to give us evidence before, we learn that you have presented a report to the Danish Minister of Agriculture, which we propose to put into the Appendix of our report, and some members of the Committee might wish to ask you questions upon it. (*See Appendix XXVI.*) Do you appear before us to-day on instructions from the Danish Government, or quite independently?—I appear here being authorised by the Danish Government to give evidence on this question.

9896. Have they expressed any views as to the requirements of the trade, or do they leave you to exercise your own judgment in that matter?—I have had conversations with them about it, but I have no written instructions on the question.

9897. I understand from the report that you have issued that you would be opposed to having a standard fixed under the reference to this Committee, based upon a Reichert-Wollny number, for instance?—Yes.

9898. Or upon any other known chemical test?—Yes. I should think that it would be a very difficult thing to establish any limit on any of these chemical tests that are at present in use which would not be open to either one of two or both objections—that it might exclude as adulterated butter, butter which was absolutely genuine, or that it might induce adulteration.

9899. That is, if it was put too low it would induce adulteration?—Yes.

9900. And if it was put too high, it might exclude some honest, genuine butter?—Yes. I think it could not be placed at any point where it would not be easily possible to obtain large quantities of butter which would allow of adulteration down to the limit. To take a special example, I suppose nobody could think of fixing a higher figure by the Reichert-Wollny process than 25, and there would be no difficulty in finding large quantities of butter so much above 25 that it would pay to adulterate them down to 25.

9901. You are an experienced chemist; within your knowledge is there any simple test which would detect the presence of added foreign fats?—I believe there are many cases where it is absolutely impossible with the means at present at our disposal to detect them; of course there are other cases where it is easy enough to detect them.

9902. Will you tell us, in as concise a way as you can, the difficulties which the chemist finds in determining genuineness with the accepted tests?—With all the tests that are, as far as I know at present, applied, it is a fact that the figures obtained by analysing various samples of butter vary, and as there is not, in many respects, any fundamental difference between butter fat and other fat, these variations within genuine butter fat could be obtained by a mixture of other fats with some of the butter fats, and then when those other fats which are added are not capable of detection by special means, as for instance sesame oil is, it would not be possible to conclude from the figures obtained whether the fat under analysis was a genuine butter fat without any admixture of foreign fat, or whether there was indeed such an admixture of genuine butter fat with foreign fats.

9903. I suppose you would agree with other chemists that have been before us that a low Reichert-Wollny number does not imply any inferiority in the article?—Yes, and I have tried to state that as fully as I could in the report that is before you. If butter is judged by practical butter merchants, or practical dairy people who are very experienced in judging the butter according to its quality and commercial value, or if it is judged by the price it has actually obtained in trade, and is then compared with the Reichert-Wollny figure or other tests, I think it will be found that there is no connection whatsoever between the quality or the price of the butter, and the chemical analysis of the butter fat.

9904. (*Professor Thorpe.*) You mean as revealed by the Reichert-Wollny method or any similar method?—Or by any similar method.

9905. By any method that you know of?—That I know of, exactly. I am quite debarred from speaking about anything that I do not know of.

9906. (*Chairman.*) If further chemical research were to discover some test which would accurately determine the amount of foreign fat introduced into an article calling itself butter, you would think that it would be of benefit to the trade that a standard based upon that test should be adopted?—Yes, a very great benefit indeed, not only to the trade, but also—and I should say principally—to the butter producers. Perhaps I may mention that some years ago the Royal Agricultural Society of Denmark offered a prize to any chemist who could discover any new test that would fulfil those conditions, because they thought it would be of the very greatest benefit to Danish agriculture.

9907. Can you say in what direction the chemists who joined in this competition sought for a test?—In connection with this prize that was offered no paper was sent in.

9908. Was no research work done, as far as you know?—It did not come to the knowledge of the Royal Agricultural Society of Denmark.

9909. You yourself knew of no persons who tried to win the prize?—No, not that prize.

9910. (*Professor Thorpe.*) What was the value of the prize?—I forget now.

9911. I want to know what was the inducement that was offered?—It is several years ago, and I forget what was the value of it. I believe it was quite sufficient to induce a Danish chemist to try for it, though it may not have been sufficient to induce an English chemist. But I do not know that for that reason we may conclude that it is impossible that somebody may yet find a way out of the difficulty.

9912. (*Chairman.*) Have you any suggestion to make to this Committee with a view to checking the adulteration of butter with foreign fats?—I have heard of some suggestions of a new method of analysis, but I do not think it is a question I could speak upon with any authority. I mean I have it only secondhand that there might still be a field that has not been fully investigated, and that might give hope of some solution.

9913. But you are not prepared to indicate the nature of these anticipations?—No, I do not think I could do that.

9914. (*Professor Thorpe.*) May I ask you as a chemist why you are not prepared to enter into it?—Because it is only something I have at secondhand from somebody who will appear, or has appeared, before the Committee, so I think it had much better come from the original source.

9915. You have reason to hope, I suppose, that it may appear before us?—I hope so very much.

9916. I understand that you base your objection to the fixing of any statutory limit in the case of butter on lines parallel to those which the Board of Agriculture has fixed in the case of milk, on the ground that the natural composition of butter is too variable?—No, that is not my ground at all.

9917. Then what is your reason?—My reason is that if in milk the solid parts—the fat and so on—fall below a certain limit, the money value of the article falls below a certain limit, while in butter there is no connection at all between the contents of, for instance, volatile acids in the butter fat and the commercial value of the butter.

9918. Has anybody ever alleged there was any connection between the Reichert-Wollny figure and the commercial value of the butter?—I believe so; I believe you did about a year ago to me.

9919. I said there was a direct commercial connection?—You put the question to me in this way: "Do you really think you can prove that there is no connection?" from which I concluded that you thought there was.

9920. That was a conclusion based upon a very slender ground?—I think you have positively stated that in your opinion there was such a connection, and you asked me, if I could, to bring evidence to the contrary; it has been stated many times that butter containing a low amount of volatile acid is really butter of such a poor composition and quality that even if it is not adulterated it would be much better not to have it imported into this country. That has been said many times.

9921. But not by me?—Then I misunderstood you, that is all I can say.

9922. Are you referring to a conversation we had on the subject?—Yes, in January, last year, in the laboratory.

9923. What I did say, if I may be allowed to repeat, was that the number of cases in which this what we may call abnormal butter came into this country was so comparatively infrequent that it was not worth while to jeopardise the position by including them in, and that it was very much better in the interests both of the butter trade and ourselves that those abnormal butters with low Reichert-Wollny numbers, although they might be perfectly genuine, should be excluded. That was the position I took up, and that is what I have consistently maintained?—Of course, in that case I must admit that I quite misunderstood you; but on that point may I add that if the objection to a statutory limit does not apply to Danish butter it applies to butter from other countries. It applies to a not very inconsiderable part, and, indeed, if you are thinking of the new and rapidly increasing import of butter from Siberia, you will find that a very considerable part of the butters that come from there have these low figures.

9924. On that point we shall have definite information; you may perhaps have definite information?—Yes, and if you will allow me, I will hand in a list showing that 26 samples of Russian butter out of a total number of 108 fell below the Reichert-Wollny number of 25. That fact is brought out by Professor Stein. (*Appendix XXVII.*)

9925. Are you prepared to be cross-examined on this list? Do you know all the circumstances connected with this importation of Russian butter?—It is hard for me to say before hand that I know all that you may ask me about; but I do not mind risking some questions on it.

9926. Over what period of time have these analyses of Russian butter been taken?—Over one year, I think, but I would not say that positively—it may be two years.

9927. You believe it is one year, but you think it is possible it may be more?—I could not say that positively—it may be two years, but, of course, I can easily ascertain.*

9928. That is a point I should like to be ascertained, as I do want to know over what length of time these samples have been taken. You tell me that a number of the samples were so-called Russian butters?—You can take it from me absolutely that those were Russian butters.

9929. Coming from where?—From Russia to Denmark.

9930. Russia is a large part of Europe, is it not?—And a part of Asia too if we include Siberia.

9931. Is it Siberia they came from?—They came from Finland, Courland, the interior of Russia, Siberia, and indeed different parts of Russia.

9932. From the northern part of Russia, in fact?—No, it is not at all confined to the northern part, because it comes from the Volga district.

9933. Does all the butter which comes from Russia to European ports come through Copenhagen?—No.

9934. The samples on this list, however, are samples of butter which have been trans-shipped at Copenhagen?—These are samples of Russian butter landed in Copenhagen from Russian ports.

9935. That is to say, from Baltic ports?—Yes, from Baltic ports, because we do not have any steamship connection between Siberia and Denmark. Siberian butter is sent by rail to the Baltic ports, and all Siberian butters are shipped from Russia through Baltic ports, except perhaps they may send some to Japan, I do not know. In this connection you may take it that all Russian butters are exported from Baltic ports.

9936. You say these are exported probably over a year, or possibly a little longer; were they taken throughout the year?—Yes. They are picked out of a total number of 108 samples analysed by Professor Stein during that period. They are not picked out from any particular time of the year with any object of making it appear any different than just the average.

9937. Are the 108 samples uniformly distributed throughout the year?—That I cannot tell you.

9938. Does the Russian butter come from Copenhagen more frequently at one period of the year than at another?—No, not to any very great extent; of course there is less coming in the winter time because they produce less then.

9939. The ports are closed, are they not, by the ice for a good section of the winter?—Then they could come through the northern German ports. But the ports are not all closed by the ice; there are ice-free ports in the Baltic.

9940. There are ports in the Baltic from which butter is exported to Copenhagen, which are open throughout the year?—Not only to Copenhagen, but also to the United Kingdom.

9941. Never mind about the United Kingdom, you said it came to Copenhagen?—Certainly.

9942. There is steamship connection between the Baltic ports where butter is shipped throughout the year?—Yes, Hango is the name of the port.

9943. We find from this list that 26 samples of this Russian butter out of the 108—in other words, about 25 per cent.—give Reichert-Wollny numbers below 25?—That is so.

9944. You have handed in a table, somewhat similar, of Professor Stein's calculation respecting Danish butter, in which you have given a list of 449 analyses

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* Mr. Faber afterwards supplied the following note:—The samples were taken at random throughout the year from the 1st January, 1898, to the 30th September, 1900. Of the samples, 64 were from Finland, and the remainder from other parts of Russia, chiefly Siberia.

Mr. H. Faber.

30 Jan. 1902.

of Danish dairy butters which show Reichert-Wollny figures below 25?—Yes, that is so.

9945. Those are taken from analyses which have been made during the four years extending from 1896 to 1900?—Five years you will find that to be.

9946. How many samples of butter have been examined in the Danish laboratory during that period?—I do not know whether I may hand in this paper on the control of Danish butter; it will answer your question. It gives the number of samples of butter and margarine analysed under the Danish Margarine Law during the last five years. (*Appendix XXVIII.*)

9947. What does "Tested by Inspectors" mean?—That is in the second table; and the second table is the one from which these 449 samples have been culled. Under the Danish Margarine Act we have appointed three inspectors with some assistants who take samples from all places where butter and margarine are to be found. Previous to 1896 all the samples that they took were sent to Professor Stein for analysis. In the year 1896, after the visit of Professor Stein to your laboratory, they made an arrangement that each of the inspectors should be furnished with a refractometer, so as to go over the samples and weed out those which were considered to be undoubtedly genuine. Those that showed a refraction of more than 42 at 45 degrees Centigrade were sent in to the laboratory for complete analysis. In this way about 5,000 samples are taken by the inspectors yearly and put through the refractometer test, and those that go above 42 are sent on for analysis, and those that are sent on for complete analyses are specified in the second column.

9948. That is to say, in 1896-97 there were 730; in 1897-98, 802; in 1898-99, 327; in 1899-1900, 81; and in 1900-1901, 159?—That is so.

9949. Out of those, 449 have been collected from the aggregate number, which means that there would be 449 what we may call below 25 out of the sum of these; is that so?—Yes.

9950. (*Chairman.*) The tests which were actually taken were only a small minority of the samples that were inspected?—Yes.

9951. Therefore the samples that were inspected, but not tested, presumably would have had a high Reichert-Wollny number?—Yes. I have put it in the report in this way, that those 449 samples are calculated to amount to about 2 per cent. of the total samples tested—which you will find corresponds with these figures.

9952. (*Professor Thorpe.*) I see you say in your report (§ 14): "On account of the way in which these analyses are compiled it is not possible to state exactly what proportion they bear to the total number of samples of Danish butter taken under the Act during the five years, but it is estimated that about 2 per cent. of these samples are represented by the 449 analyses"?—If you would like me to explain why it is not possible to state quite exactly, this is the reason:—The years here are calculated to the 1st of January, while the years in the official report are calculated to the 31st of March; therefore they do not overlap exactly, otherwise I could have calculated precisely the percentage which these 449 samples were out of the total number tested.

9953. It would not make the difference of 1 per cent.?—No.

9954. Would it make the difference of ½ per cent?—Of a tenth, or something like that.

9955. Then it is not worth talking about. In other words, you may say that not more than 2 per cent. of your butters would be affected by a Reichert-Wollny number of 25?—As a matter of fact, I believe it is slightly below 2 per cent.—say 1·9, or something like that.

9956. That percentage would alone be affected by a Reichert-Wollny number of 25. The general conclusion that you have stated is in substance very similar to what we have found happen in Holland. A large number of analyses of Friesland butter were submitted to us, extending throughout the year, and it appears that in those cases about 3 per cent. would be affected by a Reichert-Wollny number fixed as high as 25. In Denmark you say the number would be nearly half that amount?—Say 2 per cent.

9957. Two per cent. is the outside?—Two per cent. is what I have put in the report.

9958. In Holland these what I may call for the moment abnormal butters below 25 are practically all to be met with at one season of the year, namely, during about six weeks in the late autumn? Is there any corresponding period as regards Denmark?—Yes, certainly; they appear in the autumn.

9959. What time of the year do they appear precisely?—That varies with some circumstances, for instance, with the temperature and the crops; but they appear in September, October, and November, I should say.

9960. Very much at the same time then that they do in Friesland?—Most likely.

9961. And probably for the same causes?—I cannot speak about Friesland, but I can speak about what we think are the causes in Denmark.

9962. Then what are the causes in Denmark?—There are two different causes. One is that most cows are late milking at that time of the year. Another cause is the cold weather and the less substantial feeding. I have fully gone into that question in my report, and I will refer you to section 10. There I have shown the average composition of the butter fat yielded by 11 cows during the first five months after calving, and during the last five months before the cows were run dry, showing in the last column on the right-hand side a decrease of the Reichert-Wollny figure, especially during those last five months. That is the effect on the composition of butter-fat caused during the period of lactation.

9963. I should like to fully understand this: These are average numbers on the 11 cows, are they?—Yes.

9964. It appears therefore that one month after calving the Reichert-Wollny number was 31·8, two months after calving it was the same, three months after calving it went up to 32·6—that is, 8-10ths of a per cent. more—then it went down to 31·4 at the fourth month after calving, and at the fifth month it was 31·1. Do you think that those are considerable variations over five or six months?—No, I do not consider those variations have the slightest significance.

9965. Then five months before "dry" the Reichert-Wollny number was 28·8; four months before "dry," 27·6; three months before "dry," 26·8; and then, of course, it suddenly begins to drop?—Yes, two months before "dry."

9966. Just before the cow is dry it is 22·1 and then it is 22·5, but I do not attach any significance to that little increase?—No more do I.

9967. There is nothing to be argued from the difference between 22·1 and 22·5, is there?—No. Otherwise the figures show very plainly that towards the time when the cows are getting dry there is a very considerable decrease in the amount of volatile acids in the butter fat. I do not suppose that is a surprise to you because we have known that for many years; it is the same all over the world.

9968. (*Major Craigie.*) At what time of the year are they always nearly dry—in the autumn?—This is quite independent of the year.

9969. (*Professor Thorpe.*) Would it not be the fact that whilst there might be butter-fat from a cow nearly dry, that in practice would be, or might be, mixed with the milk of a cow two or three months after calving?—Certainly.

9970. So I mean to say that averages itself?—It may be mixed, certainly.

9971. Of course, if all the cows were dry at the same time, or at about the same time—in other words, if they all calved at about the same time—you would have the butter under certain circumstances at a very low Reichert-Wollny number?—Certainly.

9972. As has once or twice happened in Denmark within my knowledge in samples which have been examined?—Very likely.

9973. I am referring to a case which was investigated by Professor Stein where we had occasion to throw doubt upon the character of a butter from Denmark, and it on investigation was found to have been produced from an estate where the greater proportion of the cows were very nearly dry—a method of dairy procedure which no one has more strongly condemned than yourself?—That is so.

9974. That, however, is a somewhat exceptional condition of things in Denmark, is it not?—Yes, in Denmark.

9975. So that in general we may take it that the butter tends to show a somewhat average condition of things from the fact that the cows are caused to calve throughout the year?—Exactly. That is why I have explained that more fully in section 13 of my report. I have said expressly that we have aimed during a number of years, and very successfully so, to spread the butter production more evenly all over the year, with the result that during the last decade the exportation of butter during the four quarters in the year has been, in the first quarter 26 per cent., in the second quarter 28 per cent., in the third quarter 24 per cent., and in the last quarter—October to December—22 per cent.

9976. That uniformity of butter production is brought about by uniformity in the system of calving, is it not?—It is caused by spreading the calving over the year; in fact, by getting many cows to calve in the early autumn. That applies to Denmark, but not to several other countries.

9977. It does not apply to the same extent to the other countries?—To some countries it does not apply at all. In Siberia you would fare very badly if you made cows calve in the autumn, because the calves would inevitably die in the winter, and the cows would stand the same chance of dying as well on account of the inclement weather and the lack of food. In a country like Siberia you have to let the cows calve in the spring, for which reason the variation in the composition of the butter-fat in butter from Siberia is quite different from what it is in butter from Denmark.

9978. On that point do you know that you are in agreement with the Russian authorities?—Yes.

9979. You know you are?—Yes.

9980. The Russian representative, for example, over here in connection with the butter trade, holds the same view as to the possibility of the Danish system not being introduced into Russia that you do?—You see the Danish system involves a very large importation into the country of feeding materials. We are a small country, yet we are absolutely the largest buyers of oil cakes of any country, I believe. If you have to buy oil cake and transport it by rail to Siberia, I believe you will find the butter being produced at a figure that will hardly pay to export, so that in Siberia the cows have to be content to eat the straw that is left from the summer, like our cows 50 years ago—they were just kept alive during the winter, and in the springtime they were little more than skeletons, and then they calved. So it is at the present time in Siberia, and must necessarily be so.

9981. What proportion of the total import of butter comes to us from Russia?—I suppose it could be easily seen from the returns; I have not got the figure at my fingers' ends. It is a very quickly and largely increasing proportion.

9982. Is it 10 per cent. of the total import into this country?—It is a little difficult, perhaps, to see at a glance, because some of it comes direct from Russia, and is put down in the statistics here as imported from Russia, and a very considerable portion of it comes from Denmark, and that part has to be added to the import from Russia in order to show the proper proportion.

9983. Have you yourself got any statistics as to the amount of bona-fide Russian butter which is brought into this country?—Only in the capacity of a subscriber to the Board of Trade Returns; that is where I get my information from.

9984. You have no other independent source of information than that, have you?—No, and I do not see that I could get very much beyond that. I am afraid I do not quite understand you.

9985. I know the Board of Trade Returns, and I could tell you exactly the amount which is imported as Russian butter; but there is a difficulty, because a good deal of Russian butter really comes to us as Danish produce on account of Copenhagen being a free port?—That is what I say, a great deal of Russian butter comes from Denmark to England, and is in the return as Danish butter.

9986. (*Major Craigie.*) Is there not such a volume as the Danish Trade Reports, which shows the export, and is not there an account published in Copenhagen of the trade of the free port?—Yes.

9987. Would not that return distinguish what the Russian income of butter is, and what the exit is?—Yes, but might I add to that that it does not exhaust the question, because a great deal of Russian butter is taken into Copenhagen past the Customs boundary into the merchants' warehouses, and is then exported again.

9988. (*Professor Thorpe.*) As Danish produce?—You say that, but I do not know whether you are able to prove it.

9989. I am looking at it for a moment from the point of view of the Custom House. I do not mind being perfectly frank with you. The position I am driving at is this: Assuming that it is as you say perfectly true that a very large proportion of Siberian butter has this low Reichert-Wollny number, how am I, as an officer of the Customs, to differentiate that Siberian butter from Danish butter; there is no way of ear-marking that as Siberian butter, is there?—A good deal of Danish butter is ear-marked.

9990. I am quite aware of that?—Would it be any advantage to you if all the Danish butter was ear-marked?

9991. Certainly, or what comes to the same thing; if all the Siberian butter were ear-marked. My point is this: I venture to say that you are trying to get a concession in favour of Siberian butter; now Siberian butter in some respects is unique; but in some respects it is a thing which, as you have explained to us, is produced under conditions very dissimilar from those under which the great bulk of the butter of the world is produced, because it is, or may be, produced under circumstances of considerable climatic stringency. Now you are asking us to lower the standard, or to do away with any standard at all, in view of the exceptional character of the butter?—I am not quite certain whether I am asking you, because the question of a standard or limit for butter, I think, could be discussed quite academically, independently of Siberia altogether; and, independently of Siberia, I really do not see the justice of such a limit. The only reason that I see for putting up such a limit is simply to do away with the difficulty the analyst has in proving or disproving. It seems to me that where the goods with which we have to deal are of a lower value, when they come below a certain analytical figure, there are some grounds to go upon when we say that they should not be sold as the real thing. That is the case with milk.

9992. You are mixing up two different sets of considerations; you are looking at the commercial value of the article alone. I am looking at it as a chemist who may be called upon to apply a certain criterion of genuineness?—Yes, and that is what I object to; I do not think that is just.

9993. I have got to deal with certain methods of determining the genuineness or otherwise of butter?—Yes, as an analyst; but when the limit is set up it does not affect only the analysts. I can quite see that as an analyst you would argue that it would be a great help to you to have a certain limit so that anything falling below a certain figure you could declare to be adulterated. But I say if such a limit were set up it would affect a good many other people than analysts. It is on behalf of those other members of the community whom this limit would also affect that I was going to argue that if the fact of the butter containing less than a certain amount of volatile acid does not affect the quality or the commercial value of the butter, then I fail to see the justice of taking steps to keep it out of the country.

9994. Of course that is your position, but on the other hand, when we give away the posibility of checking the importation of, it may be, large quantities of produce which is adulterated with margarine, we have got to choose between two issues—we have got to choose which way we will go. We say a Reichert-Wollny number of 25 would at all events not exclude any very large proportion of genuine butters, with the possible exception of Siberian butters, which are still *sub judice*?—I do not know how much it would affect Holland. I had the idea that it would affect Holland to a much larger extent than what you tell me, but I have no first-hand knowledge on the subject.

9995. I have merely quoted the results of what were brought before us by Dr. Van der Zande and Dr. Van Rijn?—I have no information on the point. I know how it would affect Russia, and I say it would affect Russia very considerably, and as Denmark is very much interested in the trade in Russian butter—a very large amount of the butters that are produced in Siberia being produced on behalf of Danish merchants—then we are

Mr. H. Faber.

30 Jan. 1902.

also very much interested in the question of Siberian butter.

9996. That is the point; I should eventually, I hoped, have got that fact out of you?—If you only ask me I sha'l be glad to tell you anything—you can get it straight.

9997. I believe it is the case that you are, as a representative of Denmark, even more interested in the trade of Russian butter than, possibly, the Russians themselves?—I do not quite know whether I am more, but I certainly do represent an interest in Russian butter.

9998. Now to come back to the point from which we have a little departed, can you indicate to us how we could in a way set aside Siberian butter and treat it apart?—I could more easily indicate how you can set Danish butter apart, because we have done something, or at least the Danish dairies have done something, towards having that set apart. This is a trade-mark which was registered last year, I believe, and is used—I daresay Mr. Hickey knows all about it—by, at present, 700 dairies in Denmark. This is only a very small beginning compared with what it will be in a very short time. This trade-mark is applied to one or two staves in each cask of butter produced and sent away from those dairies. The idea is that eventually it should be used by all Danish dairies. If, for the sake of argument, we take it that all Danish butter had that trade-mark on it there would be no difficulty at all in the Customs distinguishing Danish butter, when it is landed, from other butter coming in Danish bottoms to this country.

9999. This Danish butter is actually produced in Denmark?—Yes.

10000. It is not butter which has been bought by Danish merchants and transhipped?—No, that trade mark can only be applied to Danish butter made in Denmark. Perhaps you will notice there are two holes drilled in the stave; they sent me some staves over for samples, but to make sure that I should not insert them in casks of butter and represent them as Danish butter they put those two holes through. Those staves are produced under a binding contract, so that they can only be supplied to those dairies that are members of the association which owns that trade-mark.

10001. Of course this is a purely voluntary association of Danish producers?—Yes.

10002. Are the persons so banded together a very large proportion of the total producers in Denmark?—Yes. Within less than a year 700 of our 1,400 dairies have joined, and the slightest indication that that trade-mark would be recognised here in any way in connection with butter control would make the other half join within a very short time, I should think.

10003. It is a very desirable thing, no doubt. I do not know whether the chairman would be willing to express the same opinion; but, of course, you have really touched upon the question which a certain number of gentlemen who have appeared before us have also dealt with. A number of gentlemen in connection with other butter-producing countries, especially from the Colonies, have also expressed their willingness to join in some kind of organisation—an international organisation, if possible—by which the character of their butter may be certified as it leaves the countries of origin. I gather from you that the Danes have already expressed their willingness to act in the same way?—Yes, certainly.

10004. Since you gentlemen in Denmark apparently control the production in Russia——?—That is putting it rather strongly.

10005. (*Chairman.*) Do you control the distribution from Russia?—No. If you put it that we largely deal in Russian butter I believe that that would perhaps be more correct.

10006. (*Professor Thorpe.*) I think I am right in saying that you largely control it; I will not say entirely control it?—No. I do not understand it that way. We largely deal in Russian butter, but it does not amount to as much as some may believe.

10007. But it is a trade that you have informed the Committee you are very much interested in?—Certainly our merchants are, but so are also butter merchants outside of Denmark. I believe there are some in Manchester and other towns in this country who are also interested in the Russian trade.

10008. (*Mr. Hickey.*) And Germans?—And Germans.

10009. (*Professor Thorpe.*) I think you have distinctly told us that the Russian produce is largely in the hands of Danish merchants?—I do not know whether I have said that. I have said that the Danish merchants are largely interested in Russian butter, which is not the same as saying that Russian butter is practically controlled by Danish butter merchants. We are a small country, and Russia is a large country, so a small interest in Russia may be a large interest in Denmark. I do not know whether that makes it more clear.

10010. I know the relative proportion of so-called Russian butter which is imported; the aggregate amount, so far as we can discover, is about a fourth of what you send us. You in Denmark send us about 43 per cent. of the total amount of butter which is imported into this country, do you not?—Yes, that would be so.

10011. And what is called in the Board of Trade Returns Russian butter is about 10 per cent.?—Yes.

10012. It is a little more, in fact, than what Holland sends us?—Well, there is some of that in the 43 per cent. that Denmark sends you.

10013. There is rather more Russian butter comes in than is represented by the 10 per cent. in the Board of Trade Returns, because a certain amount comes in as Danish—is that it?—Because a certain amount of it is transhipped into Danish bottoms.

10014. And that amount comes out of the 43 per cent. of Danish butter?—Yes.

10015. What I should like to get at, if I can, is what part of the 10 per cent. of Russian butter that is returned as such in our returns is controlled by the operations of Danish merchants?—I cannot tell you that.

10016. Can you not?—No. I do not see how I could. I think none of that Russian butter that comes from Russia direct to this country would be controlled by Danish merchants—not a single cask of it. What is produced for their account would certainly be dealt with at Copenhagen.

10017. It would be counted in the 43 per cent.?—Absolutely, and I think that would be 3 or 4 per cent. It is entirely guesswork on my part, but if no more importance than that is laid on these figures, I do not mind giving them. I should say that 3 or 4 per cent. of the butter imported here coming through Denmark may be Russian, and that means that from Russia direct comes three times as much as comes through Denmark. That is some measure of the importance of the Russian trade *viâ* Denmark.

10018. In other words, you say the Danish merchants control the output of about a third of what comes from Russia?—Not exactly that. I should say that the amount which comes here through Copenhagen is about a third of the amount which comes direct from Russia. I word it a little differently for this particular reason, that there is a good deal of Russian butter comes to Copenhagen, but does not leave Copenhagen again, because we eat it.

10019. (*Major Craigie.*) There again, if I may put the question, your own trade accounts in Denmark will show you the amount retained in the country for consumption?—Quite right, only it would be grouped together with the Swedish butter.

10020. They would show you how much Russian butter was retained in Denmark and how much was re-exported?—Are you quite sure that the accounts specify that it is Russian or Swedish butter? Do they not state that of the imported butter so much was retained and so much was exported?

10021. Are not the imports analysed in the Danish Trade Accounts?—I do not believe to that extent. The Account says so much was imported from Sweden and so much was imported from Russian, and so much foreign butter was exported. I do not like to speak positively against you, but I think the Danish Accounts specify the imports only by nationalities. It did not occur to me that this question might come up or I would have brought the Accounts.

10022. (*Mr. Hickey.*) You say that there is an appreciable number of samples of Danish butter which fall below the Reichert-Wollny number of 25, and even below 24?—Yes.

10023. Will you tell the Committee what you mean by an appreciable number?—Two per cent. were found to be below 25 during these five years.

10024. Would those butters be spread all over the year?—No, I think we may take it that they are all within about two months in the autumn, which would mean that it would be 12 per cent. of autumn butter which falls below 25.

10025. That is to say between September and November, about 12 per cent. of all the Danish butter made then would fall below 25?—Yes, that is how I should think it would fall.

10026. (*Mr. Dunn.*) I think you said that you were opposed to the fixing of a standard?—Yes, I think that it involves great difficulties and injustice.

10027. Do I understand you to be opposed to it, because science cannot suggest a perfect standard, or because even if it could suggest a perfect standard you would consider it injurious?—I think that it is still possible that means might be found by which you could analytically distinguish between adulterated butter and genuine butter, and I am quite convinced that if such means were in existence or were to be found, nobody would think about having a limit, and—I believe I may speak with great authority here, because Professor Thorpe agreed to it—that if we had a method by which we could distinguish between genuine butter and adulterations there would be no need or no justification for a limit.

10028. (*Professor Thorpe.*) Yes, if we had any means of spotting the actual foreign fat, of course we should not require limits?—That is my point exactly, that if we could distinguish between adulterated butter and genuine butter, nobody would ever dream about having a limit, and therefore this is only something which is taken to on account of some deficiency in our chemical knowledge.

10029. No more would anybody dream of having limits in the case of milk if we could ear-mark pump water or ear-mark the separated milk; we should not require any limits there then, should we?—I think it is quite a different matter in the case of milk.

10030. No, we adopt limits as to fat, and as to solids not fat, because we cannot ear-mark the added water or the added separated milk?—Yes, but you also have that additional inducement that this very poor milk gives a very poor return for the money that people pay for it.

10031. You will look at it only from that point?—Certainly I will.

10032. We look at it from two different points of view. I am a chemist, and you apparently are a merchant?—I beg your pardon, I should like to state that as a consumer of both milk and butter.

10033. (*Mr. Dunn.*) From a commercial point of view it is very important, no doubt?—From the commercial point of view also.

10034. And from the point of view of public policy and the interests of the consumer?—Yes.

10035. (*Major Craigie.*) You conclude your general report by stating it as your conclusive opinion that whatever happens Denmark would probably fear a high limit or standard less than other countries?—That is my impression.

10036. Less than any other countries?—I do not think I word it so strong as that.

10037. The second last paragraph in section 17 of your report is practically to that effect, is it not?—There are two things stated there—our butter is more uniform than most other butters, and it might be easier to prove the purity of a sample of Danish butter, which might be found to fall below the limit than it would be to prove the purity of a sample in many other cases.

10038. What is your reason for saying that?—When the Customs in this country take a sample of butter from a Danish port at the same time a sample is drawn from the same cask, and sent to me, and that duplicate sample is forwarded to Copenhagen for analysis. I also have information about the number, mark and shipper in Denmark from which that butter comes. I telegraph to the margarine inspector for the district where that butter comes from, who proceeds to the shipper to ask him what was the origin of the butter described by that number and mark. If it came from a Danish dairy he then draws a sample from the butter produced the week following at that same dairy where the butter was produced which was sampled in England. We have an analysis of the duplicate of the sample taken by the Customs, and we have an analysis of the butter of the same dairy made the following week, and so in any case of dispute about the purity of that butter we should be able and willing to produce evidence as to the composition of the butter at the dairy, and also of course as to the analysis of the duplicate of the sample that was taken at the Customs. Should our Government analyst find that the composition of the butter from the dairy in question gives rise to any doubt as to its purity, then the inspector would proceed to the dairy, and make a most minute investigation on the spot, and he would see a sample produced from the milk, so that he could be absolutely certain that that was a genuine sample. In that connection I would refer to the table in Section 15 of my report where there are 10 examples given of the way in which the purity of the butter has been proved when there was originally good cause to doubt it. We can begin with the first sample. A sample of butter was taken at a merchant's warehouse, and submitted to our Government analyst, and it was found to yield a Reichert-Wollny figure of only 20·1, which, of course gave rise to suspicion. The inspector was then sent to the dairy, where he drew two samples of the butter which was present in the dairy at the time of his visit. He further saw the milk arrive at the dairy, and took samples of the cream made in his presence, and sent those in. By analysis it was found that the butter fat in the cream yielded a Reichert-Wollny number even a little below 20, which was in fair agreement with the result of the sample of butter taken, and thereby proving that as the cream was pure, so must the butter have been. In a similar way we should fortify any case where a suspicion was thrown upon the purity of our butter. I believe—and that is what I refer to in this paragraph in the report to which you have drawn attention—that the machinery at our disposal for so tracing the butter to its origin with a very small loss of time is more complete than what I know of in any other country. That is why I say I believe it might be easier to prove the purity of a sample of Danish butter which might be found to fall below the limit. I refer to that also in a paper which I handed in a little while ago, which I have headed, "The Control of Danish Butter." I have also in that paper given some other information that has some connection with an earlier part of my evidence. During the year 1901, 249 samples were drawn by the British Customs of butter, arriving here from Danish ports, and out of those 249 samples 107 were butters of other nationalities than Danish.

Mr. H. Faber.
31 Jan. 1902.

10039. 107 out of 249 taken during the whole 12 months?—Yes.

10040. (*Professor Thorpe.*) Which purported to be Danish butter?—I am very sorry to have to contradict you.

10041. Was that so?—I say during the year 1901 the British Customs took 249 samples of butter arriving in this country from Danish ports purporting to be nothing else but what they were.

10042. What did they purport to be?—Butters.

10043. Not Danish butters?—No.

10044. But we took it at the Customs as Danish butter?—I am very sorry to contradict you again—you did not.

10045. (*Major Craigie.*) What you mean is that 249 samples were taken at the British Custom House of butter arriving from Denmark?—Yes.

10046. That is to say butter which appears in the Board of Trade Returns as Danish butter?—Certainly.

10047. (*Professor Thorpe.*) And in our returns, too?—I am afraid that is not correct. I refer to the report of the principal chemist of the Government Laboratory during the year ended 31st of March, 1900 (page 10): "Although Italy does not appear in the above table, 16 of the samples from Belgium and two of those from French ports were Italian produce, and two samples of Swedish and one of Russian butter were imported viâ Denmark," and so on. In the following year the report of the same authority says: "Eight samples of Russian and two of Swedish butter were imported viâ Denmark." So that the Customs do know and report to the Government Laboratory in several cases when they take samples of butter arriving from Danish ports that those butters are not necessarily Danish.

Mr. H. Faber.

30 Jan. 1902.

10048. I do not say that that is a wilful misstatement, I do not think for a moment it is—but it is the rarest possible thing that we get upon the advice notes any information which leads us to believe that these butters are other than Danish products when they come from Danish ports. I have given the strictest orders, because I have such a high opinion of Danish butter, that when any butter is transhipped at Copenhagen or at any other Danish port, if the examining officer can discover by any marks on the casks or any interrogation of the shippers or consignees that the thing is not of Danish origin, he has to state so?—Of course, I do not dispute that for a moment. I can only say that these instructions are very poorly carried out by the British Customs.

10049. However that may be, it is the rarest possible thing—so rare that you actually have given the instances there—that we get any other information than that the things are what they purport to be, namely, Danish samples, Danish butters?—They do not purport to be anything really.

10050. If they are shipped from a Danish port they purport to be Danish butters?—I am glad that you state it in such general terms as that; but is it a fact that if goods are shipped from a certain port in a certain country they purport to be the produce of that country? I do not think I need go any further than Major Craigie.

10051. By the official returns they are bound to be that; we have no means of knowing otherwise if a thing comes from Copenhagen unless there is something to show that it is not so?—I believe that in the Board of Trade Statistical Office they would very readily admit that, although they have to return those goods arriving from certain ports in certain countries as arriving from those countries, they do not thereby imply that they are the produce of those countries.

10052. I am quite aware of that fact?—That is all that I have stated, and, therefore, I think that must be taken into account, and I do not think I can quite admit that butter coming from a Danish port purports to be Danish butter.

10053. It does in the official returns?—I am not speaking about official returns.

10054. I am confining myself to official returns, and I know of no other. Let me point out that my returns are only based upon the information which I receive?—I do not say anything against them. The only thing I say is that there are sufficient indications to show that butters come from Denmark which do not purport to be Danish butters, because they are plainly marked as butters from other countries. We cannot do more than that.

10055. Wherever they are so marked, notice is taken of those marks, but it is the rarest possible thing that they are so marked?—The last return says that one sample of butter from Denmark, reported as adulterated, was described as of Swedish origin. Now it so happens that there was a law case over that sample in Hull, and not only the Customs officer but also your own officer gave evidence before the Court that that butter was plainly marked on the cask as Russian produce, and it is here described as of Swedish origin.

10056. I had some correspondence, I think, with Mr. Wedin, the Swedish representative, about that?—That may be.

10057. We at the Customs are not answerable for that misdescription of the origin of that butter?—I do not quite know who is then.

10058. The consignees of that butter?—It was plainly marked on the cask.

10059. No?—That was given in evidence before an English court of law. It was plainly marked on the cask, and it was marked and labelled on the Customs samples which I have seen myself.

10060. If this is at all relevant to our enquiry, I will produce the whole of the correspondence?—I should be quite satisfied if you only produced the Customs sample that was sent to the laboratory, which I have seen in court with a label on it describing it as Russian produce, and if you will produce Mr. Lewin to give that in evidence, so that that will satisfy the Committee.

10060*. I will make a note of that. We will ask Mr. Lewin about it, and the evidence as to that butter shall be produced?—Thank you.

10061. (*Major Craigie.*) Setting aside for the moment the question whether it is known where they come from, 249 samples was the total amount taken by the Customs here of butter arriving from Danish ports?—That is quite correct.

10062. Of these 249 samples 107 were from butter of other nationality than Danish?—Yes.

10063. How do you identify those 107 samples—you have not been able to do so through the Customs?—No, certainly not.

10064. From whom do you get your information?—In this way—as I explained a little while ago—I telegraph to the Margarine Inspector in Denmark. He goes to the exporter in Denmark, who tells him if the butter comes from Denmark, whether it is from a Danish dairy, or whether it is a foreign butter. If the exporter is a man in Sweden, or a man in Russia, that tells its own tale.

10065. Then it is assumed that the samples taken by the Customs are fairly representative of the whole trade of Denmark?—No. I should like to say it is quite clear to me that the Customs in taking samples of butter arriving in Danish ships take by preference such samples as are to them clearly not Danish butter.

10066. (*Professor Thorpe.*) How does that clearly appear to them?—Because out of a cargo the other day in Newcastle they took eight samples, and not one of them was a sample of Danish butter, and indeed all are given as being sent from other ports than Danish ports. They were sent either from Swedish or from Russian ports to Denmark, and were transhipped in Copenhagen into the ship that took them to England. I was very much surprised to hear from you that the Customs had strict orders to let you know where these butters came from. It is a puzzle to me that the Customs let you know so very little about the origin of the samples they take. You return only ten or something like that—eight Russian and two Swedish—as having been reported to you as not being Danish, but I know that there were over 100 samples in that year which were not Danish butter, and many of which were marked on the cask "Swedish butter." I have great difficulty in reconciling those two things.

10067. If you were a little more accustomed to Customs procedure you would see that there is no difficulty whatever at all in it. Wherever a Customs officer knows from the marks what is the origin of the butter he will report it. If, however, the butter comes into Copenhagen and leaves Copenhagen, or any other Danish port, Copenhagen is given as the port of origin, and it is assumed to be the produce of Denmark for fiscal purposes?—I perfectly understand that, but I have a little difficulty in understanding how, if on the cask there is plainly written "Swedish produce," they can take that to purport to be Danish butter. And with regard to your question some time ago of ear-marking the Siberian butter, I fail to see how you could ear-mark it, if you cannot be guided by a distinguishing mark on the cask.

10068. (*Major Craigie.*) It is taken from the ship's manifest, and ships' manifests only show that so much was exported from Copenhagen, and nothing else is known in the Custom House; it is not done from an examination of the casks?—I am not speaking of the Board of Trade returns. I am speaking about the report that the Customs make to the Government Laboratory when they send in the samples. When the Customs officer draws a sample out of a cask I do not see that he can possibly overlook the fact that on the lid of this cask is marked in plain letters, "Swedish produce." He copies that on to the label, which is affixed to the glass, which is sent in to the Government Laboratory.

10069. (*Professor Thorpe.*) Do you say that he does copy that on?—Yes, I have seen it with my own eyes.

10070. You say that he invariably copies it—that if he saw "Swedish produce" he would put it on the label, although he was taking it out of a Danish bottom?—I do not say that. I say he has done it in these cases that were reported to you, and in one case I have seen it done, and I do not see why he should not always do it when it is marked on the lid, when he has instructions from you so to do.

10071-2. No, he has not had instructions from me so to do; the mere words "Swedish produce" are not sufficient for me nor are they sufficient for the Customs officers. It only requires the most elementary knowledge

Mr. H. Faber.
—
30 Jan. 1902.

of Customs work to know that we are constantly getting "blinds," and that sort of thing. Imports are misdescribed purposely. All this difficulty has arisen since Copenhagen became a free port?- Long before Copenhagen was a free port Swedish butter was exported, as Mr. Hickey will be able to tell you quite as well as I can.

10073. Now this is a fact: we have reason to believe that a certain quantity of spurious butter is sent to Copenhagen to be reshipped as Danish butter, and that is how the difficulty arises?—May I ask what "spurious butter" means in this case?

10074. Butter of a suspicious character?—Do you mean adulterated butter?

10075. Yes?—You say you have reason to believe that adulterated butter is sent into Copenhagen——

10076. Is sent to Copenhagen and is transhipped; we have reason to believe that such has been the case. Butter has been sent to Copenhagen from Riga and one or two other ports that I can name to you since Copenhagen has become a free port, and that butter has been there transhipped and sent to this country as Danish produce?—May I ask a question? I do not know whether it is quite in order for me to do so. When you had reason to believe that this butter was spurious was it not at a time when your experience of Russian butter was rather more limited than perhaps it is now?

10077. I am not aware that we had a very extensive experience of Russian butter, but we certainly at one time had some very suspicious samples of butter coming from the Baltic ports?—The English Law Courts have expressed a different opinion on that butter than was expressed by your Department.

10078. Not a bit. This is butter of quite a different character from the Siberian butter which appeared in the Law Courts, and is quite a different thing altogether?—That seems to me rather a serious statement for me to listen to.

10079. (*Major Craigie.*) You suggested just now that the Customs had a regulation whereby they took samples of the butter arriving from Danish ports mainly where they had reason to suppose that they were not Danish?—I have only to say that I have drawn that conclusion from the fact that out of a mixed cargo of Danish butter with some not Danish butter they took overwhelmingly samples from that which is not Danish. Of course I have no means of knowing the instructions given to the English Customs, but I could not help having my attention drawn to the fact that the samples taken lately are so overwhelmingly out of the butter which I know is not Danish.

10080. The fact is this, that you, in the figures you gave us before, apart from evidence, said that the proportion of Russian butter coming through Denmark was perhaps about 3 per cent. out of 40 per cent.?—Yes.

10081. That 3 to 40 is a very different ratio to 107 to 249, so the figures are very remarkable?—So they are to my idea, too—very remarkable.

10082. In regard to the butter samples taken in English ports, are we to take it that you are not referring to one or two only, but to the whole of the English ports?—I am referring to all the British ports to which butter is sent from Denmark.

10083. The 107 samples were afterwards, by the method which your have yourself established, traced back to other sources than Danish?—Yes; and a very large proportion of those samples were marked as such.

10084. Of these, 31 were described as Swedish, I think? Or came from Swedish ports.

10085. Fifty-nine were described as Russian, or from shippers in Russian ports in transit, one as from Germany also in transit, and 16 were not fully described?—That is so.

10086. How do you know that the 16 not fully described were not Danish?—From the exporters of them, through the Margarine Inspector, who goes and sees all the books. You know we have a fairly complete control of the trade in butter and margarine, and our inspectors have power to go and inspect the books. In these instances the inspector has satisfied himself that these samples did not come from Danish dairies. If they had come from Danish dairies the inspectors have to draw a further sample from the same dairy.

10087. Have you noticed a change in the trade as regards the Swedish butters that come through Denmark? Is there not a good deal less coming through Danish ports from Sweden than there was some time ago?—There is less butter exported from Sweden altogether.

10088. But still a smaller proportion comes through Denmark than was the case four or five years ago, at any rate I have heard that casually stated, and I am asking you for information?—I am not aware that the proportion of export from Sweden is smaller in proportion to the whole than before.

10089. Is there not a marked falling-off in the transit trade in butter owing to changes in some of the shipping lines through Denmark?—I am not aware of it.

10090. You have not any information upon that point?—No.

10091. The whole of this digression arises from your putting the point that Denmark for her own butters does not fear a high standard, if one were fixed on the suggestion of this Committee?—That is so.

10092. But she does so much trade with Sweden, Finland, Russia, and particularly Siberia, that on behalf of her secondary trade, if we may so call it, she would deprecate a high standard?—Yes.

10093. (*Chairman.*) Or any standard at all?—Yes. A low standard, of course, would be a very serious thing.

10094. (*Major Craigie.*) Would it not be a matter of interest to Denmark, and Danish producers and Danish merchants, that the butter from these other countries in which they are interested should by some means establish a better name than perhaps they have got at the present moment in this country; are they not anxious to promote and extend their trade in Siberian and other butters?—I am very sorry, but I am afraid I did not quite grasp the question.

10095. Would not those people who are interested in this cross-Danish trade be glad to see some step taken to make that trade recommended in this country, or do they fear that it will eventually hamper the Danish trade itself if extended very largely? Do you not see a danger to the Danish home trade by the extension of the Siberian trade, for which you hold a brief?—By Danish trade do you mean the trade in Danish butter?

10096. Yes?—Do I see a danger to the trade in Danish butter?

10097. Yes, from deprecating any step which would hinder the development of the trade from Siberia?—I should think it would be the other way about.

10098. (*Professor Thorpe.*) Who is making money out of it?—The Danish merchants and the Danish carrying companies.

10099. (*Major Craigie.*) In suggesting this are you, as a representative of Denmark, taking a very logical position? You admit that as a representative of Denmark you have nothing to fear?—Yes.

10099*. For the cross-trade you have something to fear?—Yes.

10100. For the sake of that cross trade you ask us to do something, or to refrain from doing something, to injure that cross trade which is competitive trade with that of the Danish farmer?—Yes, of course it is.

10100.* Therefore you are speaking for the Danish merchant or middleman, but not for the Danish farmer?—In speaking about Russian or Siberian butter, of course I am speaking only for the Danish merchant.

10101. (*Mr. Dunn.*) Do you represent the Danish merchants as well as the Danish farmers?—Yes.

10102. (*Mr. Hickey.*) Is it not the fact that the importation of Russian butter into Denmark is not handicapping or interfering with the trade in Danish butter into England, but that it is displacing the sale of margarine for local consumption in Denmark?—I would put it rather differently: whether Russian butter comes to this country through Copenhagen or from Russia direct, it comes here, and we cannot help it, and whether it comes one way or the other it does compete with our butter and other butter in this country; if it comes through Copenhagen we are earning some commission on it, and we have the freight on it.

10103. (*Professor Thorpe.*) You are officially stated to be the Agricultural Commissioner to the Danish Government?—Yes, I know.

Mr. H. Faber.

30 Jan. 1902.

10104. And now you are holding a brief, not for the agricultural industry for which you are the representative Commissioner——?—Not alone.

10105. But for the Danish middleman, the merchant, the man who tranships the butter?—For the Danish merchant as well.

10106. (*Mr. Hickey.*) And partially for the Danish consumer?—Yes, if you like to put them in, but I do not see that they have anything to do with it here. If I might explain again the position of the trade through Denmark in this Russian and Siberian butter, it is this, that whether it comes through Danish hands or not it does come here.

10107. (*Major Craigie.*) It would not come here if we established a Reichert-Wollny number of 25, because you have told us that that would keep it out, but that is the very step you are asking us to refrain from taking?—Do you think it would not come here?—

10108. All the cases under 25 per cent. would be checked?—I am not so certain that it might not come here. Of course, that is a question between England and Russia that I could not be supposed to give an opinion on.

10109. (*Chairman.*) As it has already appeared in the newspapers, I may tell you that this Committee have recommended in an interim report, which has been presented to Parliament, a limit of 16 per cent. for water in butter; will you tell me how that would affect the trade in which you are interested?—I think that is a very proper recommendation, and I am highly pleased to hear that 16 per cent. of water has been recommended.

10110. (*Major Craigie.*) Can you give any information as to the number of dairies in Denmark in the years 1898 and 1901 which were worked by steam, and which used cream separators?—Yes. I divide them into three kinds of dairies, namely: first, co-operative dairies worked by farmers co-operatively; secondly, private dairies which buy milk from farmers; and, thirdly, estate dairies working only the milk produced on the estate. In the year 1898 there were 1,013 of the first class, 260 of the second, and 271 of the third, making a total of 1,544. In the year 1901 the first class had increased to 1,057, the second had been reduced to 209, and the third had been reduced to 140—that is just about one-half. That shows the movement that has been going on for many years. The small dairies are ceasing to exist as separate producers, and are either joining the existing co-operative dairies or forming themselves into additional co-operative dairies. This has an effect on the composition of the butter, because it excludes more and more abnormal compositions, and makes the butter more uniform.

10111. Then the effect of the change of policy whereby larger co-operative dairies are substituted for small estate dairies or purely farmers' dairies is in the direction of making the Danish butter a better product than it was before, because it is becoming more uniform?—Yes, it has that effect.

10112. And to that extent it strengthens what you have already told us about the quality of the Danish butter?—Yes; that is not exactly the reason why they do it, although it has, of course, had the effect of making the butter more uniform. The reason why they do it is because the working expenses are so much smaller in large dairies than in small dairies.

10113. Your point is this, that a smaller number of total dairies makes a larger output, and their output is of a more uniform quality?—Yes.

10114. Is there any other point you wish to bring before us?—No, thank you.

EIGHTEENTH DAY.

MEETING HELD AT
ST. STEPHEN'S HOUSE, WESTMINSTER.

Friday, 31*st January*, 1902.

PRESENT:

The Right Hon. HORACE CURZON PLUNKETT (*Chairman*).

Professor T. E. THORPE, C.B., LL.D., F.R.S.
Major P. G. CRAIGIE.
Mr. CHRISTOPHER DUNN, J.P.
Mr. PATRICK HICKEY.

Mr. A. E. BALLEINE, *Secretary*.

Mr. OTTO HEHNER, F.I.C., recalled; and further Examined.

Mr. O. Hehner.

31 Jan. 1902.

10115. (*Chairman.*) You appear here as a delegate of the Institute of Chemistry of Great Britain and Ireland and of the Society of Public Analysts?—Yes, I do, together with my friend Dr. Dyer.

10116. Have you any instructions as to the evidence you shall give to this Committee, or do you express only your own opinions?—I particularly submitted the matter to the Institute of Chemistry and the Council decided that I should give my own opinions. In regard to the Society of Public Analysts Dr. Dyer and myself have tried to obtain the opinion of its members. We have got a large number of replies in answer to certain questions which were put to them, which with your permission I will ask you to let Dr. Dyer give you in his evidence.

10117. As we know you yourself have been for a large number of years interested in the question of the analysis of butter-fats?—Yes, I have been at it for many years.

10118. For how long?—Since 1874, I think. I have practically worked at it almost every day of my life.

10119. Would you give to the Committee a rough historical sketch of the progress of science in connection with butter analysis?—In the year 1873, I think it was, a Committee of the House of Commons sat on the adulteration of food, and one of the main points which was then made by those who were against the proposed legislation was that even such important things as butter could not be analysed, and that consequently it was unnecessary and useless to make specific legislation

Mr.
O. Hehner.

31 Jan. 1902.

At that time I had been working at butter-fat, and I submitted indirectly to the then Committee of the House of Commons a method for the analysis of butter-fat which I had worked out, and which was founded upon this, that whilst ordinary fats were devoid of soluble or volatile fatty acids, butter did contain a larger quantity than had hitherto been supposed. Up to that time it was believed that it contained about 2 per cent., whilst I found that it contained a much larger quantity. I failed, however, at the time to find a method for the exact determination of these volatile acids, and I came to the conclusion that it was simpler to determine not the volatile acids, but the rest of the fatty acids. I found, in conjunction with my friend Angell, that whilst ordinary fats gave about 95 or 95·5, butter-fat gave about 85, and that there was a large margin to deal with to distinguish between butter and other fats. At that time there were no mixtures, as far as we knew, and the method was perfectly good at that time to distinguish butter-fat from other fats. It was rather a troublesome method to determine these insoluble fatty acids, and a great many efforts were made, and successfully made, by other chemists to get at the same information in an easier way. It was soon shown how to determine the soluble and volatile fatty acids by other chemists who worked at it, namely, Dr. Dupré and Dr. Muter, and the same thing was done by Koettstorfer by measuring the saponification equivalent—that is to say, by measuring the amount of potash which was necessary to decompose the whole fat, which is greater in the case of butter-fat than in the case of other fats. Then the idea occurred to Dr. Bell, Professor Thorpe's predecessor at Somerset House, that if there was so much soluble or volatile low molecular fatty acids in butter then butter should be heavier than other fats, and so it was found. Then it was found that it was more convenient, instead of determining the total volatile or soluble fatty acids to determine only a conventional fraction of it. That process, introduced by Reichert, and modified endlessly by other people, has ultimately come into general use. But all these mean one and the same thing, namely, the determination directly or indirectly of the volatile or soluble fatty acids.

10120. When you say directly or indirectly, do you mean either by measuring the soluble acids or by measuring the others?—Either by measuring the soluble acids, or by difference by measuring the others. Say that we have a foot-rule divided into 100 parts, and one person estimates a certain thing to measure 85 or 86 parts, then the remaining 14 or 15 parts is the measure of the other. Then physical methods like taking the specific gravity mean the same thing. An immense amount of ingenuity has been displayed in determining these factors, and in making the methods as convenient as possible. Modifications absolutely without end have been proposed which have led to an immense literature, but it all means the same thing, and whilst to the outsider it may appear as if a large amount of work had been done on the subject a remarkably small amount has been done really, and in essence.

10121. Is the iodine-absorption process founded on the same principle?—No, that stands on a different footing. It was found that margarine, or the substitution butters, contained a larger amount of olein, and as olein is measured by the amount of iodine which it can absorb, and butter as a rule has a low iodine absorption, therefore the iodine absorption was also drawn into the service of this mode of distinction. The same thing again in a physical manner has been accomplished, or thereabouts, by estimating the refraction of a ray of light, which is less in the case of butter than in the case of margarine. The refraction test has come much into use because nothing is needed but to put a little droplet into an instrument and to look down a tube, and to read a number on a scale. It is therefore highly convenient as far as it goes. At that time all these methods were perfectly good for what was the original intention, namely, to distinguish butter from margarine. About the year 1874 there were practically no mixtures, but very soon mixtures were made with large quantities of margarine up to 60 or 70 per cent. The methods were perfectly good for that. But gradually as the dealers found that these mixtures could be detected by analysis, and often by taste, they whittled down the percentage of margarine which was added, and less and less was added until they found at about what stage of addition those methods of butter analysis broke down. Those methods broke down because butter naturally varies in composition under the most favourable conditions, and consequently there is a margin more or less large where mixtures and genuine butter would overlap.

10122. When did these tests first come to be discredited? Was it about the year 1889?—Yes, I think about then there was brought to light a fact which went over the world interested in butter that certain samples which had been declared adulterated by English public analysts were nevertheless conclusively proved to be genuine.

10123. I think that was proved by Mr. Allen's mission to Denmark?—Yes, and also by Dr. Vieth's experiments at Horsham on the Aylesbury Dairy Company's farm. Dr. Vieth personally took the milk of a large number of cows, separately prepared the cream, and analysed the butter made from it. He also gave me portions of the butter which he made himself. In many cases these butters did not conform to what up till then was believed ought to be shown by all genuine butters.

10124. I understand that from the year 1889 onwards chemists have ceased to have the same confidence that they formerly had in the methods for accurately determining the amount of butter-fat?—I think so.

10125. Has the science of analysis progressed at all since then?—Not materially. The chemist did not think, if I may say so, that these things were of sufficient importance. The exceptions were few and far between; they did not occur under the usual conditions, and they were mostly observed in the case of single cows. Chemists therefore thought that it was not within the range of practical politics, as far as butter is concerned, to pay too much attention to the exceptions, as it was possible to establish that a particular butter was a genuine butter, although it did not conform. In Irish butters I have known for a long while that exceptions are common, and within the last five or six years it has gradually got very apparent that these exceptions are common at certain times of the year in Dutch butters; almost every November or December for perhaps six or seven years past there have been quarrels between English analysts and the Dutch producers or Dutch analysts, because we get from Holland a great many samples which do not conform with our ideas of what butter ought to be; but I think it is plainly established that that is due to natural, and possibly to preventible causes.

10126. What have you to say about Siberian butters?—Within the last two years, perhaps a little longer, a very large quantity of Siberian butter has come into the market. Enormous quantities come now, and a great many of them are exceptional. I looked yesterday through my notebooks for the last six or seven months, and I picked out forty samples of butter which were sent to me as Siberian, and of those thirty per cent. were below anything which I would meet with in English butters.

10127. Below what Reichert-Wollny number, would you say?—May I say that I have been always old-fashioned enough to stick to the Reichert number only, and that the Reichert-Wollny number and the Reichert number are not quite comparable? People generally think that a Reichert-Wollny number being obtained from twice the quantity of fat is twice that of the Reichert number, but it is not, and consequently they are not quite comparable. I found out of those forty samples that twelve, that is to say, 30 per cent., had a Reichert number of from 10·3 to 12·0; if those figures are multiplied by 2·2 that will give as near as one can roughly get at it, the Reichert-Wollny number.

10128. (*Mr. Hickey.*) Could you tell us what it would be in the Reichert-Wollny number?—10·3 multiplied by 2·2 would be about 22·7. That is the lowest that I met, and I have of course met a good many perfectly normal ones, indeed seventeen out of the forty were normal.

10129. Does that mean that they would show a Reichert-Wollny number of 25?—25 is wretchedly low; 25 is not normal.

10130. What is the normal figure?—The normal Reichert figure, of which I have some experience, is about 13, or slightly over 13, which means about 29 in Reichert-Wollny—29 would be a fair average normal figure.

10131. (*Professor Thorpe.*) For Siberian butter?—No, for butter generally.

Mr. O. Hehner.

31 Jan. 1902.

10132. (*Mr. Hickey.*) I meant for Siberian butter?—I do not know what is normal for Siberian butter, as they vary so much; they go from the usual figure of 30 Reichert-Wollny down to about 22.

10133. You found 30 per cent. of the forty Siberian butters with a Reichert-Wollny number of 22·7?—Yes. I might have gone back further of course, but I took the last few months. Twelve out of the forty gave me a figure below 12 Reichert, which is 26·4 Reichert-Wollny.

10134. (*Professor Thorpe.*) One can see from that, that although there may be now and again Siberian butters with exceptionally low numbers the general average of Siberian butter is not very dissimilar from that of butter from the rest of the world?—I do not agree with that. Of course if one takes 25 Reichert-Wollny as representing the rest of the world (which I think is an assumption not warranted), that would be so.

10135. I do not take 25?—Well, 26 even would be ridiculously low.

10136. As far as I have been able to follow you—perhaps I have not picked it up very accurately—even your average number for Siberian butter is somewhere about 26 or 27 Reichert-Wollny?—I have not worked out the average, but as I have said, out of the forty samples there are seventeen which are thirteen Reichert, that is 28·6 Reichert-Wollny and upwards, that is to say perfectly normal butters; I have eight which are between 12·5 and 13 Reichert, which is still moderately normal; and fifteen which are what I consider much below the normal.

10137. Below the normal, or below the average—I do not quite understand what you mean by the normal because we have not yet got your idea of what the normal number is?—I think myself that 13 Reichert is a fair average for butters, but not a high one. Disregarding November samples, and Siberian samples, 12·5 Reichert would be, in my opinion, a low figure for genuine butter—and that is the point where it begins to be suspicious; everything below that I would say is decidedly suspicious or wrong.

10138. (*Mr. Hickey.*) Did fifteen of the samples show a Reichert-Wollny figure of 22?—One did.

10139. Some would be 23 probably?—Yes, and upwards to about 26.

10140. Then there was only one sample that showed a Reichert-Wollny figure of under 23?—I do not know that it was only one, but I think so; of the several that I have taken 10·3 Reichert is the lowest.

10141. (*Professor Thorpe.*) Were these samples of Siberian butter distributed all over the year?—Yes, more or less. I started my statistics last summer, and have gone up to about the present time. At first the bulk of them were perfectly normal, that is those that I obtained we will say in August, or thereabouts, last year were quite normal.

10142. When would those butters be made at their place of origin?—I should say about a month before, but of course I do not know whether they were cold-stored or not.

10143. You understand my point?—Perfectly.

10144. I want to know whether you are able to connect any of the Siberian butters with the time at which they were produced?—I think so. There is the same lowering in their autumn butters as in the Dutch butters, and I think it is mainly the autumn butter which is low.

10145. We were informed yesterday that the peculiarity of the Norwegian butter is that it is the summer butter which is low, and the autumn and winter butter which is uniformly high?—I have not so much experience of Norwegian butter, but with Finnish butter I believe this is to be the case—frequently when I have Finnish butters, no matter at what time of the year they were produced, I have found them low, and, indeed, I have got an impression that Finnish butter was almost always low. But in regard to the Russian butters, as far as I can with my limited experience form an opinion, because this thing has not been going on long, I believe that they are mainly low in the autumn. Quite lately I procured some samples—about six or eight—from a large house, and they were normal, that is to say, about 13 Reichert.

10146. The point I want to elicit from you is: Do you regard Siberian butters as highly exceptional butters?—No, only that this change in autumn is probably there more accentuated than it is in the middle European countries. No doubt the winter sets in earlier there, and the farmers are probably still less educated than they are elsewhere, and no doubt they keep their cows out when a good farmer, a knowing farmer, would stable them.

10147. It has been represented, and assiduously represented, in view of this Inquiry, that the Siberian butter introduces an utterly new factor into the situation?—I think it does not, but it accentuates an already existing factor. That which happened now and then, and which could be almost disregarded in small countries like Holland, is rather accentuated in a country like Siberia, from which we get an immense quantity of butter. I have not looked at the statistics, but I have heard from butter merchants that 10,000 barrels come into the Port of London per week. If one-third of those has a lower number than the average—I do not care if it is only at one time of the year—that introduces a factor which certainly must puzzle the public analyst.

10148. I think you rather exaggerated the amount of Russian butter as compared with the other butter that is imported into this country. However, the Returns of the Board of Trade will tell us accurately what there is. According to those Returns there is on the average about the same amount of Russian butter as there is of butter imported from Holland. Are you aware of that?—That is right; it is about 10 per cent.

10149. (*Major Craigie.*) Do you know anything of a very large increase in the course of the present winter?—I know nothing of that except that I myself as an analyst have got within the last six months a great many more Russian butters than I ever had before—no doubt because much more attention was paid to Russian butter from an analytical point of view.

10150. Have you any information as to the parts of Siberia from which those butters come, because Siberia is a very large place, and covers a good many degrees of latitude?—I could not give you that information. I have heard it, but I do not know much about Russian geography, and so the information has not stuck.

10151. You are of course aware that the climate of Siberia varies very considerably in different parts?—Yes, it does. But I am afraid that I cannot give you any information where these butters come from. In view of its climate, and of its winter, I have through the kindness of Mr. J. Marshall Dugdale, of Llanfyllin, near Oswestry, been able to experiment with some herds of cows split up into two portions, the one half being stabled at the right time, and the other half kept out. I have found exactly what experience would lead one to believe, namely, that the Reichert number fell very much in the case of those kept out—it fell to about 10 or thereabouts, which is equivalent to about 22 Reichert-Wollny.

10152. (*Mr. Hickey.*) Was that lately?—This autumn. On the other hand, I have tried to procure exceptional Dutch samples and exceptional Danish samples, and I have found the greatest possible difficulty in doing so, because their autumn has been a particularly mild one, and so the exceptions have not commonly occurred either in Denmark or in Holland.

10153. (*Chairman.*) Taking the test which analysts have agreed among themselves to apply, and rely upon now, as I understand it, you are of opinion that it is not practicable to differentiate between certain butters with a large percentage of margarine and butters with a normally low Reichert or Reichert-Wollny figure?—I agree. All the methods which are based upon—and they are all based upon—the determination of the volatile fatty acids will not enable you to distinguish between a mixture and a naturally low butter provided it is within certain limits.

10154. That is excepting the iodine absorption and the refraction tests, upon which you do not rely?—No. Speaking from experience, they show me little.

10155. Then you do not recommend that this Committee should report in favour of any standard or limit being applied under all those tests?—No, I am clearly of opinion that the time would be a most inopportune one to lay down any limits based upon our tests as hitherto practised. Whatever the frequency of these exceptions may be, we know now clearly that exceptions are not unfrequent. We know that a fluctuation in the amount of the volatile fatty acids is greater than was believed to be the case when these methods came into general use. I am strongly under the impression that our search for methods must be resumed from a different point of view altogether.

10156. I presume you would agree with other analysts who have been before us that there is no constant relation between the composition of the butter-fats and the dietetic or commercial value of the butter?—I have for years past been trying to trace whether there is a connection, and I have come quite clearly to the opinion that there is absolutely no connection between the composition of butter and its commercial value. The commercial value is solely a question of flavour and consistency: that is to say, of care in the manufacture, and has nothing to do with the composition of the fat. Consequently I take it that to take a limitation number below which butter should be considered adulterated, or not fit for consumption, or devoid of nourishment as in the case of milk, is not tenable, and that it would not be fair to exclude from that point of view any exceptional sample as not being of the substance, nature, and quality of butter.

10157. You have drawn a distinction between the cases of milk and butter. Would you draw the same distinction between the amount of water in butter and the composition of the butter-fats on the ground that the purchaser buying a butter containing an undue amount of water is prejudiced?—I take that very strongly to be the case, exactly as in the case of milk. The water is under control, and if I get too much water I am cheated out of so much food.

10158. Have you heard of the recommendation of this Committee with regard to the water in butter?—I saw it in the "Times," and I was very pleased except with one little addition that you made.

10159. What was that addition?—If the "Times" has correctly reported you, that the notification of more water should absolve the vendor.

10160. We made no recommendation to that effect. All that we said was that we feared that was the state of the law?—I hope, then, you have added that a new law should be made to prevent that, exactly as has been done in the case of the addition of butter to margarine, which is limited to 10 per cent.

10161. That is a matter for legislators?—I know, but such a recommendation would come with great force from the Committee.

10162. I have one more subject upon which the Committee desire your assistance. Can you suggest any direction in which research should be prosecuted in order to discover a test which will detect and accurately determine the presence of foreign fats in butters?—I can make a number of suggestions. I have been working on this question for some years, and I have got some very hopeful results which are based upon this, that we do not look for that which characterises butter, and which makes our methods excellently good for finding butter, but that we look for what we want to look for, namely, margarine. Hitherto we have never looked for margarine. We have always looked for butter positively, and by exclusion have come to the conclusion that there must be margarine, which seems to me to be as absurd as if a chemist wanted to look for arsenic and looked for the seventy odd elements that there are excluding arsenic, and not finding all those, says that there must be arsenic.

10163. Is margarine the only foreign fat that it is difficult to determine in butter?—It depends upon what is understood by the term margarine. Formerly it was quite easy to obtain positive evidence of the presence of margarine, that is to say margarine was a mixture of animal fats and certain vegetable fats, namely, cottonseed oil, which gave an excellent chemical reaction, and sesame oil, which can be easily discovered. So for years we were enabled to discover margarine containing these fats, even when the figures of their analyses, of which I spoke before, did not give any decided indication. But nothing can be kept secret. In every police court case the public analyst is forced to give his reasons, and this thing comes out in no time. Then the clever manufacturers, especially in Holland—large margarine manufacturers—at once say we will make a margarine solely for mixing, and they will leave those things out; and everybody in the trade knows where to get margarine made for mixing. Then the distinction is gone, and that remark which I made just now I know from bitter experience to be true. They follow most keenly what we are doing, and therefore anything which I may say as to future methods I think it is most unwise to publish in a blue-book, or to give publicly to those people. Honest people are not in the least interested in the proportion of volatile fatty acids in butter. It is only the scoundrels in the trade who are. For years past I have been pressed by my clients when I say, "This butter is genuine," or "That butter is adulterated"; "Will you give us the Reichert-Wollny figure?" and I have said, "No, if you are an honest man it does not interest you. If not, I am not going to give you any assistance." I have been threatened with actions for libellous language, but they have never come off, and I have always refused to give that information, until in the law courts these figures were forced out of us, and they became public property. From that time the whole of the mischief dates. I think the same thing will happen again if we make public any new methods whatsoever, and that they will be taken hold of solely for the purpose of defeating us. We may be quite sure that in the long run, if we do it openly the chemist will be defeated by those who want to cheat by the aid of chemistry.

Mr. O. Hehner

31 Jan. 1902.

10164. Then you do not wish that anything you may tell the Committee now should be published?—No, it should not be taken down at all, but I would be most delighted to tell Professor Thorpe, for instance, of any step I have been taking, or from which I hope success.

10165. (*Professor Thorpe.*) You have told us that since 1874, at all events, you have been directly connected with the analysis of butter?—In 1874 I published a little book on the subject.

10166. That is a period of over a quarter of a century?—Yes.

10167. That association with the work of butter analysis has brought you into very direct contact with the butter trade?—Yes, very intimately.

10168. I am not, I believe, exaggerating or unduly flattering you when I say that you have probably more experience of the analysis of butter than anybody in England?—Probably.

10169. In fact, I may say almost certainly you have had a larger number of samples of butter passing through your hands, and through your laboratory, than any single English chemist?—Or anybody else in the world.

10170. On the basis of that experience are you in a position to say that butter adulteration is very prevalent?—I think not now. For a time it was very prevalent, but owing to the great public attention which has been paid to the subject by the late Food Products Committee of the House of Commons, since that time I think it has got very much less in the direction of margarine, but in the direction of water it has got very much more. As to the question of water, will you allow me to mention one thing? I met a butter merchant in the street only two days ago—I do not think I shall be divulging anything confidential because it was said openly—and he told me: "We take Siberian butter, and we add water up to the limit of 15, but we never go over 15." If they add that amount of water to Siberian butter which comes in with, say, 9 or 10 per cent. then it pays to add 5 per cent. of water. But that is a difficulty with a standard of any kind. That has nothing to do with us now, but it is interesting.

10171. You give the Committee to understand that butter adulteration is not by any means rampant?—No, I do not think it is so much as it used to be.

10172. What has mainly checked it?—I do not know, I do not think it is the analyst who has done it, although to some extent he has.

10173. It is, however, the existence of analytical machinery, however imperfect, which has checked this thing?—Yes, I suppose so.

10174. And brought it down to a point which, in your opinion, I will not say is a negligible point, but at all events is a relatively small point?—Yes, but no doubt also the prices of butter have influenced it. Butter is coming into the country in an immensely increasing quantity, and it is not likely to go up in price. Then there is another point. There is no butter famine possible since butter is cold-stored, and, consequently, prices are kept level. Violent fluctuations in price used to bring about adulteration; when suddenly a large profit could be made there was an inducement to add margarine. Now, when a large quantity comes over from Siberia or Australia it is cold-stored, and it is ladled out, as it were, when wanted. I think that has a great deal to do with it.

10175. The economic conditions which are at present existing, and the fact that butter is being brought in at

Mr. O. Hehner.

31 Jan. 1902.

all times of the year from all parts of the world, the various imports thus complementing one another, that is when there is a deficit in one part of the world, there is an influx from another—those economic conditions have tended to enhance the general character of butter?—Yes.

10176. So far as regards the malpractices which you alluded to as going on in Holland, have they been largely held in check by the operations, secure or otherwise, of the analyst?—Yes, I suppose so.

10177. You would lead us to believe therefore that these methods, relatively imperfect as they are, have nevertheless achieved a certain measure of public good?—A vast amount of good.

10178. And therefore you think that from that point alone there is no reason to disturb the *status quo*?—No, I suppose there is no reason to disturb that, only the position of the public analyst has got much more difficult. He is much more likely to pass samples at the present moment which, even a few years ago, he would have declared adulterated; and that knowledge will very soon filter through, and we shall get adulteration again.

10179. Does not that rather point to some other system of control or verification to be joined up with our present methods, imperfect as they may be?—That would be one way of dealing with the question if you can devise a reasonable one.

10180. Of course, as you have pointed out, the number of butters that we may call abnormal is comparatively low?—Taken on the total import, yes.

10181. It is very rare, for example, that we find an abnormal sample coming from the Colonies?—Very rare, but it does happen.

10182. It occasionally happens?—Yes.

10183. And it is very rare, for example, that one comes from the Argentine?—Very rare.

10184. These abnormal samples mainly come from districts like Siberia, Denmark, and Holland, where the cows are occasionally exposed to severe climatic conditions?—Yes, undoubtedly.

10185. And much of which, or some portion of which, is remediable?—Yes.

10186. And would be remedied by the existence of a limit value?—It might in time be remedied, I believe, in a small State like Holland, or an intelligent State like Denmark—I am speaking of intelligence from the dairy point of view. You might force the farmers there to swaddle their cows in eiderdowns, and to put them very early into the stable, and so prevent any butter with low volatile fatty acids coming into the market—if it be reasonable.

10187. You have argued the question as to the essential difference in your mind between the case of milk and the case of butter, and you have founded an argument upon the fact that the commercial value of butter does not depend upon the factor which we have made the basis of the limit value?—I do not think it does.

10188. Whereas, of course, in the case of milk the commercial value does directly depend upon one of those limits which have had a certain statutory force given to them?—Yes.

10189. May I point out to you that that is not quite the aspect in which the thing presents itself to me, at all events under the terms of our Reference?—I quite understand that there is a different aspect.

10190. What, of course, I am considering with the other members of the Committee is how to devise methods by which a presumption of the addition of foreign fat, namely, of a cheap material like margarine, shall either be sustained or rebutted; the purely commercial aspect of the question is, of course, not germane to that part of the enquiry—that is probably for somebody else to determine?—Quite so.

10191. And, of course, the question of the dietetic or nutritive value of the article does not come into consideration either from that point of view?—When you once give up the similarity between milk and butter that does not come into the case at all.

10192. It is simply a question of policy?—Yes.

10193. It is a fact, is it not, that so far as can be ascertained the nutritive value of margarine is not less than butter?—It is probably larger, taking heat equivalent for heat equivalent.

10194. Probably, as it has less water, a pound of margarine has a greater nutritive value than a pound of butter?—Yes, and there is another reason: as it has a higher molecular weight, probably the heat of combustion is higher. I think the great value of butter is founded more upon its physical nature than upon its chemical nature. After all, the milk contains the fat in a very much finer state of division, which carries itself into the butter, than in an artificial emulsion.

10195. Are you aware that direct experiments have been made upon the relative nutritive values of the two articles?—Yes.

10196. What do they show?—They show that there is no difference.

10197. (*Mr. Hickey.*) Is margarine as digestible an article of food as butter?—I think the fat of margarine is probably as easily digested as butter; but margarine, I rather think, is not so easily digested as butter because the emulsion is not so fine; but that is only an impression. The experiments which have been made show no difference except that people relish butter more than they do margarine; people get disgusted with margarine, when they do not do so with butter.

10198. (*Mr. Dunn.*) You are of opinion that in the present state of science it would be undesirable to adopt any standard?—Yes, I think so.

10199. You think that the public honesty is better protected by leaving the analyst a free hand?—I think so. May I also say that I am very much afraid of exact processes of analysis and of exact limits being laid down? I want to keep the public analyst as intelligent an officer as possible. That has been my aim ever since I have had anything to do with them. When a limit is laid down, coupled with an exact process prescribing the size of flask, the length of boiling, and the size of the flame, and so on, the analyst becomes nothing less than a machine, and when you once have a limit there is danger of retarding progress.

10200. You seem to be of opinion that those who want to adulterate, not knowing exactly the methods by which they will be stopped, will be more afraid of the analyst?—I think so.

10201. (*Mr. Hickey.*) You gave the Committee certain reasons which you think have conduced to reduce the amount of adulteration during the last ten years?—Yes, as far as my impression goes.

10202. Has the better administration of the law tended also in that direction?—It has also tended in that direction, not only in butter, but in any other article also. It is well known that in districts where the Food Acts are properly worked, and where a large number of samples are taken, adulteration in all articles goes down, whilst where there are few the percentage is large.

10203. You referred to the Reichert-Wollny number in Irish butters. Did you come across many cases of Irish butter where the number was low?—Yes.

10204. At what time of the year was that butter made?—I have not looked the matter up, but I do not at present have any impression on my mind that it was connected with any particular time of the year.

10205. Would you be inclined to think that Irish butters were as low as any other butters that you have analysed?—Under the same conditions, I think so.

10206. What was the lowest Reichert-Wollny number that you got?—I have no direct recollection, but I should think a number of 10 or 10·2 Reichert, which is about 22 or 22·5 Reichert-Wollny.

10207. At what time of the year was that?—I could not say at present. Whenever I have to deal with a butter which I know to be West Irish especially, I give it somewhat more latitude in Reichert or Reichert-Wollny than other butters.

10208. If you get a butter with a Reichert-Wollny number of 22 or 22·5, and you find that all your other figures are consistent with purity, would you certify that it was adulterated?—As a matter of fact, the other figures cannot be consistent with purity; they must all be exceptional if the analysis is properly done.

10209. If you found those other figures normal?—Then I would say that I had made a mistake somewhere. I have tried to explain that practically all these things are measuring the same thing. If I measure a distance with a foot rule, or with a metre rule, or with a Russian measure, they must all agree when converted into their equivalents. You are at present asking me what I should do if the metre rule showed an entirely different quantity; I would conclude that I had made a mistake somewhere.

10210. We have had evidence that you can get abnormal figures with the Reichert-Wollny number?—Then the insoluble fatty acids are higher, and the specific gravity is influenced by it, and the Koettstorfer number must be influenced by it.

10211. Then all these numbers more or less check each other and confirm each other?—That is much more like it; they check each other, but it means the same thing. May I also say, arising out of that, that it would be absurd to require an analyst to take all these numbers that are known at present? They all measure the same thing, and they serve to show what care has been bestowed upon the analysis, but they give no additional information worth having.

10212. (*Professor Thorpe.*) May I point out that you cannot say that they have all precisely the same weight?—Not quite; there are small differences.

10213. They have not precisely the same weight even as analytical determinations?—That is so.

10214. An important advantage of the Reichert-Wollny number is that any number of analysts will agree?—Yes.

10215. They may not agree in two determinations of Reichert, or in any one of the others, but the great value of the Reichert-Wollny system is that it makes the conditions precise?—True. No doubt the conditions could be made equally precise with any other determination if many samples are to be examined. I suppose that a hundred times more Reichert-Wollny numbers have been determined than, for instance, the insoluble fatty acids. I believe that Professor Thorpe could easily lay down conditions for any one of them in order to make it precise.

10216. I venture to say that it is not very easy to lay down precise conditions for the determination of the soluble fatty acids; it is a method in which there is a great deal more of the personal element in it than the other?—Far too much.

10217. Why all analysts are agreed to take the Reichert-Wollny number is because the conditions there admit of such precise definition that they are all taking precisely the same language?—Yes, and it is easy.

Mr. O. Hehner.

31 Jan. 1902.

10218. It is relatively easy, but it is not easier than the Reichert?—The Reichert might have been standardised just as well as the Reichert-Wollny. I myself think it was a misfortune that somebody took it into his head to double the quantity of fat to be taken. There was no object to be gained by it, and precision of method could have been as well applied to the one process as the other. It only introduced confusion, and did not do a bit of good.

10219. It simply accentuated the differences between butter and butter by taking 5 grammes?—I do not think the doubling of anything accentuates any difference worth speaking of.

10220. But there is the experimental error?—I quite agree that the error gets less, but it is not worth while to disturb an experience which has been extended through tens of thousands of things solely to gratify the personal vanity of a man who wishes to attach his name to a method.

10221. You have made some severe strictures upon the value of indirect methods of analysis, but I suppose that is only in the specific case of butter, or were you referring to indirect methods in general?—No. Sometimes you cannot avoid it. With water in milk you cannot possibly avoid it, because we do not know a reaction for added water; but where a reaction can be found the chemist always looks for it; I do not know of any exception.

10222. Is it not the fact that some of the most accurately determined chemical constants we have are the result of indirect methods?—True.

10223. Half the atomic weights we possess are constants of that order?—Yes; but that is hardly a case applicable to butter analysis.

10224. But you stated it in an unqualified way—that it was wrong *ipso facto*, because it was indirect?—I will correct that. Of course, we never do anything direct; we do everything by difference. If we take a weight we do not put the thing on the balance; we put it in a crucible first, and consequently it is indirectly weighed, but I am sure you, Professor Thorpe, would not misunderstand what I said.

10225. I am only correcting the impression that I am afraid you would create by your statement owing to the want of qualification?—Thank you.

Dr. BERNARD DYER (D.Sc.Lond.) recalled; and further Examined.

Dr. B. Dyer.

10226. (*Chairman.*) You appear, I understand, with Mr. Hehner, as the nominee of the Council of the Institute of Chemistry, and of the Council of the Society of Public Analysts?—Yes.

10227. Were any steps taken to ascertain the opinions of the members of the Society of Public Analysts as to that part of our reference to which we have now come, as was the case in the water part of our inquiry?—Yes; as in that case the secretaries of the Society of Public Analysts addressed to each member of the Society resident in the United Kingdom (excepting Sir Charles Cameron, to whom, as a member of your Committee, it was not thought proper to address our inquiry), and to one or two public analysts who are not at present members, a request to state briefly their opinions on that portion of the general reference that is now engaging the attention of your Committee.

10228. Will you give us the results of this inquiry?—The questions put to our members were as follows:—(1) Do you consider it desirable that a legal standard should be fixed as a criterion of the genuineness of butter-fat? (2) If so, what process or processes (mentioning them briefly by name) do you think should be prescribed? (3) And in such case, what figures do you consider should be fixed as minimum limits below which butter should be regarded as adulterated with foreign fat, until the contrary is proved? These questions were addressed to about 240 members of whom about 80 actually hold appointments under the Sale of Food and Drugs Acts. Only 61 members have responded to the request for their opinion, including 43 public analysts. Of these, 34 gentlemen holding appointments as public analysts, and 11 analysts not holding such appointments, considered that it was desirable that a legal standard should be fixed. One correspondent considered that a standard of limit might be fixed, but only as a make-shift till our present knowledge enables us to determine adulteration with more certainty than at present. One considered that in our present state of knowledge either the standard must be a low one, opening the door all round to systematic fraud, or different standards must be taken for butter from different sources. The latter process, as he pointed out, would involve the disclosure of the origin of the butter at the time of sale; failing this ordinary standards should apply. Another was doubtful in his reply. Eight public analysts, representing between them eight counties and 22 boroughs, considered that at present there was either no sufficient reason or insufficient ground for adopting a legal standard or limit. One of these gentlemen expressed himself strongly, to the effect that any so-called standard would be artificial, temporary and misleading; that the process would vary with the kind of foreign fat, and that to prescribe a process would be impracticable; that the idea of standard legal processes and limits in the case of butter was, as he expressed it, founded on a fallacy, the wise minimum limits in any given process varying with the time of year; and that to fix them legally would be to legalise fraud. Others declared that the adoption of a fixed limit was impossible without either legalising adulteration or condemning the innocent. One or two of those public analysts who are at present opposed to the fixing of a standard considered that the existence of such a standard would be desirable, but that at present it would be impracticable. Four members of the Society, not holding appointments, also expressed themselves as opposed to the fixing of a standard at present, two of them on the ground that any standard that would be generally applicable to genuine butter would be so low that moderate adulteration would escape; one member replied that in his opinion "butter should be

Dr. B. Dyer.

21 Jan. 1902.

butter"—a pious and admirable sentiment which, however, does not appear to help us very much. Some of the members who doubted the advisability or practicability of at present fixing a standard were, however, good enough to answer the question as to what processes of analysis should be prescribed in the case of such an official prescription being made. Of all those who, whether in favour or not in favour of the fixing of a standard at present expressed preference for particular methods, 44 members recommended the Reichert distillation process or one or other of its well known modifications. Of these, 22 recommended only this process; of the other 22, ten recommended, in addition to the Reichert process, the determination of the insoluble fatty acids as a standard process, with in one case, the suggestion that the soluble fatty acids also should be determined. Nine members rerecommended the use of the refractometer. Five members recommended that the specific gravity should be also taken. Four considered that the saponification or Koettstorfer equivalent should be determined. Two considered that the iodine number should be taken, and one member only recommended the adoption of the Valenta test. These various tests were all suggested in addition to the Reichert process, or some modification thereof. In reference to our request for information as to the figures that should in the opinion of members be fixed as minimum limits below which butter should be regarded as adulterated with foreign fat until the contrary is proved, some members who have sent us their replies are in the habit of using the old Reichert process, working on 2½ grammes only of the fat, while others use the Reichert-Wollny process using 5 grammes of fat. In order to make the standards or limits suggested by the two classes of workers comparable, we have translated the 2½ gramme numbers into Reichert-Wollny numbers by multiplying them by 2·2.

10229. I believe you are ready to hand in a statement illustrating what you have just told us?—Yes; but it must be understood that the members express themselves in favour of limits which, whether of the one process or of the other, correspond to the Reichert-Wollny numbers now given in the following table:—

In favour of a Reichert-Wollny limit of—

26·4 c.c.	- - - -	1 member.
26 „	- - - -	1 „
25 „	- - - -	9 members.
24 to 25 „	- - - -	2 „
24 to 26·4 „	- - - -	1 member.
24·4 „	- - - -	1 „
24 „	- - - -	9 members.
23 „	- - - -	6 „
22 „	- - - -	4 „
20·4 „	- - -	1 member.
20 „	- - - -	3 members.
No limit suggested by	- -	6 „
Total	- - -	44 „

10230. Do you wish to give any further particulars as to the replies made?—Yes. One of the members who suggested the limit of 25 thinks that at least a year's notice should be given to enable butter producers in cold climates to make such arrangements for housing their cattle earlier as will tend to obviate the low Reichert figures found at the onset of cold weather. The limits suggested for the subsidiary methods referred to were as follows:—

90 per cent.	insoluble	fatty acids	suggested	by	3 members
89½	„	„	„	„	2 „
89	„	„	„	„	4 „
88	„	„	„	„	1 member.

Of those recommending the use of the Zeiss refractometer, three suggest that the limits taken should be 54 scale divisions at 25 degrees Centigrade; one suggests 50 at 30 degrees Centigrade; two suggest 44 at 40 degrees Centigrade; and one suggests 42 at 45 degrees Centigrade. All of these limits are merely different expressions of Zeiss's ordinary limits. The remaining two suggest no limits. Those recommending the taking of the iodine number suggest as limits 35·5 and 38 respectively. Those recommending the taking of the specific gravity suggested as limits 0·911 to 0·913 at 37·8 degrees Centigrade, 0·910 at 37·8 degrees Centigrade, and 0·865 at 99 degrees Centigrade.

10231. Have the Council of the Society given any expression of opinion since receiving these replies?—The Council of the Society have considered all the communications received from the members of the Society and have anxiously discussed the whole question and have felt compelled to come to the decision that in view of the variable character of a number of the butters now coming into this country, when judged by the present methods employed by analysts, they are opposed to the fixing at the present time of any limits for the composition of butter-fat. They feel that the methods known do not suffice to satisfactorily discriminate between butters of variable origin and admixtures of genuine butter with moderate quantities of foreign fat.

10232. Then I understand that you are free to express your own individual opinion on the whole subject?—Yes, at the same time being requested to report to your Committee the different views held by our members.

10233. (*Professor Thorpe.*) By the individuals?—By the individuals, including the individual members of the Council who discussed this matter in council.

10234. (*Chairman.*) It is your individual opinion that the time has not come to fix a standard or limit in connection with the butter-fats?—Yes, and that is clearly the opinion of our Council. Our Council feels that the matter, being one of great national importance, should be made the subject of a special experimental inquiry with a view of arriving, if possible, at some new method of analytical investigation competent to cope with the difficulty. I am instructed by the Council to make it clear that that is the strong view of the Council.

10235. Have there been any recent developments in the butter trade which have caused the Council to come to this strong opinion of which you have just told us?—Undoubtedly the mass of knowledge which we have lately otained on the frequency of abnormality in Dutch butters has been taken into account, but more especially the large influx of Siberian butter to which Mr. Hehner referred in the course of his evidence.

10236. (*Professor Thorpe.*) You are a public analyst?—I am, for several counties.

10237. Do you regard your duty as a public analyst as the most important part of your professional work?—It is the most responsible part of my professional work. In what sense do you mean is it the most important?

10238. Is it that which occupies most of your time?—It occupies a large share of my time every day, but have a great many other duties to perform as well.

10239. Do you consider your duty as a public analyst the most important part of your work?—It is the most important part of my work from the public point of view.

10240. I have gathered from your examination-in-chief and from reading your synopsis that practically you are not representing the Council of the Society of Public Analysts—practically you have dissociated yourself from the Council, and you are speaking now in your individual capacity as an analyst?—My own opinions coincide with those which I have been requested to express by the Council of the Society of Public Analysts.

10241. Did they pass any resolution on the subject?—Yes.

10242. Have you got the exact terms of the resolution?—This is the actual resolution: "The Council of the Society of Public Analysts, having taken steps to ascertain the views of their members on the subject of the composition of butter, after considering the replies received, decide that, in view of the variable character of a large number of the butters now coming into this country when judged by the present methods employed by analysts, they are opposed to the fixing at the present time of any limits for the composition of butter-fat: They feel that the methods known do not suffice to satisfactorily discriminate between butters of variable origin and admixtures: The Council therefore leave their representatives free to express their individual opinions on the subject, and to report the different views held by the members of the Council: The Council consider that the question involved, being one of national importance, should be made the subject of special experimental inquiry." That is the actual resolution which was carried and which is on the minute books of the Society.

10243. Was that unanimously carried?—I think it was, but if it was not unanimously carried it was carried *nem. con.* There was one member present (who was not a public analyst), and he would personally have liked the fixing of a standard. I do not think he voted against

Dr. B. Dyer.

31 Jan. 1902.

the resolution; indeed he may have acquiesced in it—virtually it was unanimous.

10244. We find from your statement that your circular asking for information went out to 240 people; is that the entire membership?—Not quite. It was not sent to members residing abroad; it was sent to every member residing in the United Kingdom and to one or two old members of the Society who do not happen at the present time to be members but who are public analysts.

10245. You got, you tell us, 61 replies out of the 240?—Yes.

10246. I suppose a considerable fraction of your Society are not public analysts in the ordinary sense of the term?—I think, roughly, about 30 per cent. of our members are public analysts holding appointments under the Act.

10247. About one-third, we may say?—Perhaps rather less than one-third; I should think 30 per cent.

10248. Therefore you would scarcely expect, perhaps, answers from a much larger proportion than you received—at any rate, you were not surprised?—No, a great many of the members of the Society would not be interested in butter at all.

10249. We may interpret the relatively small number of replies received as due to the circumstance that the question did not interest professionally a large proportion of the men to whom the circular was addressed?—Yes, I quite think so—as compared with the whole Society.

10250. You tell us that 61 out of 80 who are actually holding appointments did take the trouble to fill up your circular?—Yes, 61 members did reply.

10251. And of these 43 were actual public analysts?—Yes, 43 out of 80 members of our Society, or thereabouts, who actually hold appointments under the Sale of Food and Drugs Act. I think that was taken out of last year's list, and rather more than half of those have replied.

10252. Of the 43, 34 consider it desirable that a legal standard should be fixed?—Yes; 34 considered that it was desirable.

10253. That is to say, a considerable majority of the 43 gentlemen who actually did hold public appointments as public analysts?—That is so—a standard, though they have very variable views.

10254. I quite admit that, but they said it was advisable and expedient that a standard should be fixed?—Yes.

10255. And in addition 11 gentlemen who are not public analysts in the ordinary sense of the term also shared their belief?—Quite so.

10256. So that 45 out of the 61 who responded to you were of opinion that it was expedient to fix a legal limit?—Yes.

10257. You have given us in your examination-in-chief an analysis of the replies which you received, but it is not quite clear from what is stated whether the replies were from gentlemen who recommended that a legal standard should be fixed, or whether the replies were from gentlemen who rather deprecated the fixing of a legal standard. Take the first reply—is that a correspondent among the 45 gentlemen who desired that a standard should be fixed?—Yes; I think he was the gentleman who considered that a standard of limit might be fixed, but only as a makeshift till our knowledge enables us to determine adulteration with more certainty than at present. He was one of those who were returned as being in favour of the standard.

10258. That general reply does not, obviously, cover all the cases that are enumerated. I find another gentleman saying in his reply that he was doubtful. What are we to understand from that?—I think that is a gentleman who said that he was not in favour of a standard if so highly technical a process was to be used as that described on a certain page of the "Analyst," meaning the process which was drawn out by the Joint Committee including yourself and your colleagues.

10259. You mean that he thought the Reichert-Wollny process was a highly technical process?—Yes. If it was adopted he said he would be in favour of so-and-so, and then he gave certain figures. I called him doubtful in collating the replies.

10260. He thought the Reichert-Wollny process a highly technical one?—He said he was not in favour of a standard if it was obtained by such a highly technical process and so on, and then he said if it was adopted the Reichert-Wollny figure should be so-and-so. I put him down as doubtful.

10261. You say one of these gentlemen expressed himself strongly to the effect that any so-called standard would be artificial, temporary, and misleading?—Yes, I think he has already given evidence.

10262. We have probably had before us some of the other gentlemen who replied?—I do not know really, but I believe some of the gentlemen have given evidence before you.

10263. How long have you been a public analyst?—I really forget.

10264. Twenty years?—No, not 20; it might possibly be 15. I have been in practice 25 years, and during the greater part of that time I have been a public analyst. It is only during the last five or ten years that I have been largely engaged in the work of a public analyst. I had only a small appointment in earlier times, but I was appointed a few years ago public analyst for Leicestershire, then for Rutland, and then for Wiltshire.

10265. Have you frequently got butter samples to analyse?—Yes; very frequently, from my inspectors.

10266. Have you formed any definite opinion as to the relative prevalence of the adulteration of butter?—Excluding these doubtful butters which turn up from time to time, and about which I am not able to make up my mind, I should say that there is not a great deal of adulteration.

10267. Is there less now than formerly?—I can scarcely form an opinion about that.

10268. Anyhow, have you frequently to take a case into court?—Very frequently, but then it is a case either of the substitution of margarine altogether or of a mixture like half-and-half, where a man has taken up a pat of margarine and beaten it up with a pat of butter in his shop.

10269. In his shop?—Probably in his shop. I have a number of cases of that kind. I have had cases where one is able to take out the margarine at one part of the sample and the butter at another part. I have had cases from time to time of butters containing low proportions of volatile fatty acids about which I really did not feel able to form an honest opinion as to whether they were butters adulterated with some foreign fat, or whether they were Dutch butters of exceptional quality, or some of these other butters to which reference has so often been made.

10270. Are you able to answer my question as to whether the adulteration of butter is increasing or decreasing?—Of my own personal knowledge I am not able to answer that question.

10271. But you are of opinion that it is not very prevalent?—I really do not know; I have absolutely no idea as to what degree the practice of mixing small quantities of margarine with butters of what we may call high quality exists—I have not the slightest idea, and I have no means of knowing.

10272. (*Mr. Hickey.*) You have given us a list of 44 members, 38 of whom were in favour of the fixing of a limit by the Reichert-Wollny process; were all those public analysts?—I think all of them but three or four would be public analysts.

10273. How many of those analysts were in favour of a Reichert-Wollny limit varying from 20 to 25?—Thirty-six of them appear to be. Out of 44 members six suggested no limit, and that leaves 38 giving a limit; one of those suggested 26·4 and another suggested 26, and all the rest suggested 25 or less.

10274. Going down as low as 20?—Yes. You will see how strongly these members who replied feel that if a limit is to be fixed it must be a low limit—what I should call a disastrously low limit—because you have no fewer than 23 out of 38 suggesting 24 or lower, which is an exceedingly poor limit.

10275. (*Mr. Dunn.*) Would you consider 24 a disastrously low limit?—Yes. I think it is a matter of commercial common sense. It seems to me absolutely certain that if such a limit as 24 were fixed an enormous business would arise immediately in mixing margarine with Australian butter, Australian butter being what, with regard to the Reichert figures, we may call a high butter. If it were made known that anything over 24 was safe to sell, then it seems to me there must be adulteration immediately. Three of our members suggest 20 even, and one suggests 20·4; that would leave room for an

Dr. B. Dyer.
31 Jan. 1902.

adulteration of 35 per cent., or something of that kind. That shows the great difficulty there is.

10276. Forty-five out of 61—that is, practically, three-fourths of those gentlemen who replied were in favour of fixing a standard?—Yes; but, mark you, that standard, in the opinion of many of them, was an exceedingly low standard.

10277. Although they differ considerably as to the point at which the standard should be fixed, three-fourths of them are practically in favour of a standard?—Of a standard of some sort, yes.

10278. Then I presume you regard it that the weight of opinion amongst the Society that you represent is strongly in favour of fixing a standard?—That is the opinion of the members who replied, but I do not quite like to call it the opinion of the Society. The Council of the Society, who considered all these replies, were decidedly of opinion that at the present time it was not desirable.

10279. It is important from our point of view, because the weight of evidence before us, as will appear, is decidedly against fixing a standard in the present state of knowledge. Nevertheless, I think you gave us to understand that the 61 gentlemen who replied out of the 240 were probably those who were more conversant with butter analysis than were those who did not reply?—There are a great many very conversant with the subject who did not reply; out of about 80 public analysts, 34 did not reply, and they, presumably, did not reply because they did not feel in a position to reply or to express any opinion.

10280. (*Professor Thorpe.*) Are there gentlemen who hold positions as public analysts who are not members of your Society?—There are.

10281. How many, do you know?—I should not think there were twenty, and several of those, at any rate, would be medical officers of health who were public analysts little more than titularly.

10282. (*Mr. Hickey.*) Were they amongst those who did not reply?—They were not asked, not being members. There were two members whose names were still on the list of our society, but who had retired during the year, who received circulars, and a circular was also sent to one other public analyst, who had been a member of the society, but the inquiry was not addressed to any public analyst who had not been connected with the society.

10283. (*Mr. Dunn.*) Notwithstanding the fact, however, that practically three-fourths of the members who replied were in favour of a standard, the Council, considering the whole question, passed that resolution against the standard?—Exactly.

10284. What is your own opinion upon the subject?—My own opinion is that it would be very inopportune to make a standard at the present time. I think that the position should be left exactly as it is until we can do something better than we can do at present. I think the suggestion of our Council of some serious attempt being made under the auspices of the Government to devise a new process is one which should be carried out. I quite agree with what Mr. Hehner has said on that subject.

10285. (*Chairman.*) Are you hopeful as to the result?—I am hopeful.

10286. (*Mr. Dunn.*) The Council, I presume, may be taken as being hopeful on that point?—I think so

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NINETEENTH DAY.

MEETING HELD AT BURLINGTON HOUSE, PICCADILLY, W.

Tuesday, 13*th May*, 1902.

PRESENT:

The Right Hon. HORACE CURZON PLUNKETT (*Chairman*).

Professor T. E. THORPE, C.B., LL.D., F.R.S.
Major P. G. CRAIGIE.
Mr. CHRISTOPHER DUNN, J.P.
Mr. GEORGE GIBBONS.
Mr. JOHN GILCHRIST.
Professor J. M. THOMSON, LL.D., F.R.S.
Mr. PATRICK HICKEY.

Mr. A. E. BALLEINE, *Secretary*.

Mr. EDWARD N. FENWICK FENWICK, called; and Examined.

Mr. E. N. F. Fenwick.
13 May 1902.

10287. (*Chairman.*) The Committee are aware that you have come to us at a considerable personal sacrifice, and we are extremely obliged to you for your assistance?—Thank you; I am only too happy to come, but I am afraid I cannot tell you much now that I have arrived.

10288. You are the magistrate at Bow Street?—I am now at Bow Street, but I have only been there since last December.

10289. Have the proceedings under the Sale of Food and Drugs Acts, and the Margarine Acts, about which you are going to give us evidence, been chiefly at Bow Street, or elsewhere?—I should say elsewhere. Having regard to the time I have been at Bow Street, I would not like to speak about these proceedings there. Before going to Bow Street I was at Marlborough Street, and there we certainly had very few of such cases.

10290. Are we to take it, then, that you have only had a few of these cases as a police magistrate?—Personally I myself have not had a great number.

10291. Still you have had to consider the law on these points?—Of course I have had to do that.

10292. I believe you have seen the reference to this Committee, and that you are aware that we have issued an interim report dealing with the question of water in butter, and that a regulation has been made carrying out the Committee's recommendation, which will come in force in two days from now?—Yes.

10293. Can you tell us whether you approve generally of the regulation, and of the effect it will have on the procedure in your Court; I mean will the fixing of a standard facilitate the procedure?—I think so.

10294. Have you seen the evidence which Mr. Mead gave before this Committee?—Yes; your secretary was kind enough to send me a copy, and I read it through.

10295. Can you say generally as regards the percentage of water in butter that you agree with his view?—In phraseology I should rather differ from him sometimes, but I think I see what he meant, and in substance I think I agree with him.

10296. Can you tell the Committee how you would deal with this concrete case: Supposing an inspector went into a shop and procured a sample of butter under the Act, and the seller of that butter said, "There is 25 per cent. of water in this butter"; if proceedings were taken after the regulation fixing a standard comes into force, would the onus of proving that the butter was genuine be upon the seller of the butter?—Undoubtedly; but in that case he would have given notice when he says, "There is 25 per cent. of water in this butter."

10297. I will read to you the actual recommendation of the Committee: "We therefore recommend the adoption of a limit of 16 per cent. for the proportion of water in butter, to be fixed by a regulation under Section 4 of the Sale of Food and Drugs Act, 1899, and we make this recommendation on the assumption that butter containing a larger percentage of water than 16 per cent. will escape the operation of this limit, provided that a sufficient disclosure is made to the purchaser." Do you agree that the assumption contained in the latter part of this recommendation accurately represents the state of the law?—Might I ask what is meant by "Escape the operation of this limit"?

10298. What was in the Committee's mind was that wherever the onus was placed a satisfactory defence would arise out of the declaration, and that the case would be dismissed?—(*Professor Thorpe.*) That is the point; perhaps the phraseology is not quite the happiest, but what we really meant in effect was that if due notice had been given by the vendor to the purchaser of the butter that the butter contained more than the legal limit of water, that would be a valid defence?—I think that is so, because that would amount to notice.

10299. (*Chairman.*) But still the onus of proving that it was genuine would be upon the vendor?—On the vendee—on the purchaser.

10300. Do you mean that the onus of proving that it was not genuine would be on the purchaser?—That would be so *primâ facie;* he would have made his proof when he put in his analyst's certificate, and then it would be for the vendor to prove if he could that it was genuine butter.

10301. Would he have to prove that if he had declared that the percentage of water was above 16?—No, I should think not. My opinion is that if he proved that he had stated to the purchaser that the percentage of water was above 16, then he would have given him notice.

10302. In other words, it would be wrong to bring a suit at all if excess of water was declared, no matter how great the excess, and no matter whether the water was fraudulently added or otherwise?—So long as a man tells the purchaser what he is buying, if he says to him "What you are going to have is butter and water," there is nothing to prevent that man selling him butter and water. Whether he does give him such notice is a question of fact in each case. Some magistrates on the same evidence might find the fact one way and some might find it another. But it would be a question of fact whether he had given the purchaser notice that he was not selling him butter.

10303. Has the case of the Pearks, Gunston, and Tee butter been before you?—No; I have never had one of those cases, but I have seen them reported.

10304. Are you aware that what you have said practically decides the law in that case, because they advertise that their butter, being blended with milk, necessarily contains a large percentage of water?—I think there has been a recent case or two with regard to that particular butter, and I think it has been held that the notice they give is a good notice. I think there was a case a little time ago, where one of the magistrates held that it was a misleading notice because it did not describe the particular constituents of the butter; but I think the Court above said, "That is not necessary; it does give the purchaser notice that he is not buying butter, and if he wants to know what he is buying then let him ask." That appeared to me to be the result of the decision, but I have only seen the newspaper report of it at present.

10305. I will now ask you to consider the case of adulterants of butter other than excess of water. You may have noticed the distinction which Mr. Mead drew between the two cases. He told the Committee that water must always be contained in butter, and the only question which arose there was as to the quantity of water; but he said that the presence of foreign fat in butter raised a presumption of fraud. Would you agree to that?—I would say that in my opinion the presence of foreign fat in butter would be evidence that what was supplied was not butter—that it was butter and foreign fat.

10306. May I ask what tests have ben adduced in your Court to prove the genuineness or otherwise of butter alleged to contain foreign fat?—I have had so very few of them. Assuming first of all that the vendor wishes to show that it was a genuine butter, I apprehend one test would be to trace the cream to the cow. Another way in which I presume that he might do it would be by calling the butter dealers who have dealt with him, and who are familiar with the butter in his neighbourhood and in his district, to say, "I have known this man's farm, I have dealt with him for a number of years, I have bought all his butter. I have bought all the butter of the farmers in that district; I collect it, I deal in it; and this butter is the ordinary butter which I get from that farm."

10307. I was rather thinking of the scientific tests applied by analysts than of the evidence as to the origin of the sample?—I do not know that I have ever had any case contested on that line. I do not know that it has ever come within my experience.

10308. (*Mr. Gibbons.*) I will put it in rather different words than those you used just now. Would you fine a man for selling butter which contained, say, 30 per cent. of water, when the purchaser was told it contained over 16?—There you are putting to me a question of fact; you are asking me to decide the fact whether the purchaser had notice.

10309. He was told that it contained over 16 per cent. of water, but the vendor did not say how much over, and it was found to contain 30 per cent. of water?—If you ask me to decide it as a question of fact—somebody else might decide it the other way—I should say that he had given him notice—"You have got here over 16 per cent. of water."

10310. I am assuming that there was 30 per cent. of water in the butter, and that he was simply told that it was over 16?—Then the purchaser is put on his guard, and he can say, "How much water is there in the butter?"

10311. You would not fine the vendor in that case?—I do not think I should, but I should like to hear all the facts in the case; it is entirely a question of fact there.

10312. (*Mr. Dunn.*) Will you assume as a matter of fact that the vendor has made a sufficient declaration?—It would be a question of fact in each case. The vendor would have to show that he did make a sufficient declaration.

10313. Assuming that the vendor makes a sufficient declaration, then are all other questions as to the onus of proof unnecessary?—I think that decides the matter if he gave the purchaser notice.

10314. That ends the question?—Yes, it does, if you are satisfied that he said in substance, "I am not selling you what you are asking for, but something else."

10315. (*Mr. Hickey.*) Suppose a shopkeeper put a printed notice on his butter bearing the following words—"This butter contains about 20 to 22 or 25 per cent. of moisture"—would you regard that in itself as a sufficient disclosure of the amount of moisture that was in the butter?—If the notice said that it contained "about" that?

10316. Yes?—How much moisture are you assuming was disclosed by the evidence?

10317. If the evidence showed that the butter contained much more than 22 or 25 per cent. of moisture, you would convict?—Personally I should.

10318. If it contained less what would your attitude be?—Then I should not convict.

10319. Would such a printed notice in your judgment be a sufficient protection for the vendor of the butter, without his having to make a verbal declaration in addition?—I think if the vendor says a butter contains about 20 per cent. of water, and it is shown that it does contain about 20 per cent. of water, he has protected himself, your standard being 16. He has given his customer, the purchaser, notice of what he is going to sell him; the customer asks for butter, the vendor says, "I am not going to sell you pure butter—I am going to sell you a butter that contains 20 per cent. of water."

10320. Have you read Section 4 of the Food and Drugs Act, 1899, which is the section under which all these regulations are made?—Yes.

10321. Does it in any way supersede the general principles of the Act of 1875?—I think it does not deprive a man of any defence which he might have had before.

10322. Then the principle of disclosure being implied in the Act of 1875 is, in your opinion, continued under the Act of 1899?—I think that is clearly so.

10323. Would you also insist that a shopkeeper should sell his butter in a wrapper bearing a notice of a similar character to what he would attach to the butter?—Do you mean would I insist upon it as a matter of

Mr. E. N. F. Fenwick.

13 May 1902.

policy? Of course I could not insist upon it as a matter of law, because there is nothing to compel him to do so. Whether it is desirable for the protection of the public is another large question, and it is hardly a question for me to express any opinion upon.

10324. Would you consider that in order to comply with the law it would be necessary to make a verbal disclosure at the time of sale?—A verbal disclosure certainly would be enough.

10325. Would not the mere putting of a wrapper on the butter, or of a label, be sufficient in itself, without putting the shopkeeper to the inconvenience of having to continue making a verbal disclosure?—It would be a question of fact for the magistrate to decide in each case whether the notice had come to the knowledge of the purchaser. Sometimes it is done by putting up a notice at the back of the shop; if the purchaser does not see it he has no notice, and if the shopkeeper does not draw his attention to it and does not mention it, then he has not had notice. In all these cases you are rather putting to me questions of fact.

10326. If such a notice were printed on a shield, for instance, and attached to the butter, or put into the butter, so that a person coming into the shop could read it, would that be a sufficient disclosure?—It would be entirely a question for the magistrate who tried the case to say whether that notice had been brought to the purchaser's knowledge in every case. A man might say, in spite of the shield, "I am prepared to swear I did not see it," and you might find a magistrate who would believe him when he said that he did not see it. On the other hand, another magistrate might say, "It is utterly impossible that he did not see it; he must have seen it; it is perfectly certain that he did see it."

10327. (*Mr Gilchrist.*) I think the Lord Chief Justice gave a decision with regard to one case of the Pearks, Gunston, and Tee butter which stated or implied that the result might have been different if other butters had been sold in the same shop. Was that so?—He said that if other butters had been sold in that shop other matters would have to be considered. He said that there was no evidence that butter other than Pearks's butter had been sold there, and therefore it did not become necessary to consider the other matters to which he was referring, and he did not mention what they were. The evidence being that only Pearks's butter was sold in that shop, he assumed that only Pearks's butter was sold there, and as there was a notice in the shop which informed the purchaser of the particular constituents of which Pearks' butter was made, and as the purchaser saw that notice, he had notice that he was buying something that was not genuine butter. That, if I remember aright—and I am speaking from memory only—was in substance what the case came to.

10328. If a case were to come before you where the facts were the same except that other butter was sold in the shop, would that exception influence you in expressing an opinion different from the judgment delivered by the Lord Chief Justice?—I think there is a great deal to be said for the view you are suggesting, because if other butters are sold in a shop, and you walk into the shop, and you presume that the man is an ordinary butterman selling butter, and you ask for butter, although you may see a notice about Pearks' butter, you have not asked for Pearks' butter, you have asked for butter, and you are entitled, I presume, to have butter.

10329 In answer to Mr. Gibbons you stated that if a man declared that he was selling butter that contained over 16 per cent. of water you personally would not be inclined to convict him, because it was in the power of the purchaser to ask him how much more. Then in answer to Mr. Hickey you stated that if he declared that butter to contain 22 per cent. of water, and it was found to contain 25 or 26 per cent. of water, you would convict him, because it contained more than he had stated, is that correct?—I think so. In one case he tells you the exact amount, and he has not told you the truth; in the other case he leaves it ambiguous as to how much it does contain, and leaves it to you to make further inquiry. In the one case the man says, "This butter contains 22 per cent. of water"; he tells you how much, and the fair assumption from that is that it contains no more.

10330. You are aware that the onus of proving himself innocent lies upon the party who is brought to the bar in the case of butter. He is in a different position from parties brought to the bar for other offences, where the prosecution must prove them to be guilty before they are convicted; here the onus of proof under the regulations for the milk standard and for the butter standard lies upon the one who is brought up?—I think I know what you mean, and I would accept what you mean on my basis; but I would rather say that, having given his evidence and put in the analyst's certificate, your standard then shifts the burden of proof upon the vendor.

10331. If he proves himself to be innocent, has he got to bear the expense of proving his innocence without getting anything returned?—Like any other defendant, he certainly has to pay for his own defence. I do not know any fund where he would get it from.

10332. That is so at present?—Is it suggested that there is any fund from which he could get the expenses of proving his case?

10333. I was merely asking as to the fact?—There would be no order made by the Court that he would get any money. The costs of all these cases are in the discretion of the magistrate, and if he acquitted him, he might give him a sum for costs.

10334. Has the magistrate power to do that?—Yes; the costs are entirely in the discretion of the magistrate, but I have never known a case in which the costs have been given to a successful defendant.

10335. (*Chairman.*) Would this not be rather an exceptional case? If I understand you aright, if a man makes a sufficient disclosure of the amount of water in his butter, then the case will surely be dismissed?—Yes.

10336. Yet you say that under the regulation the onus of proof that the butter is genuine will rest upon the seller of the butter, but—as I also understand you—he does not have to prove it at all, because you are dismissing the case simply on the disclosure?—You are putting to me two different cases; one defence is disclosure, and another defence is that the butter is genuine.

10337. Then you would require a definition of genuine butter before you could administer the law, would you not?—I do not think that. The inspector would get into the box, and he would give his evidence. He would say: "I asked for butter, and this was supplied to me." The defendant has two defences which he might set up. He may say first of all: "Well, I have given you butter, and it is genuine butter that you have got"; or he might say, "I admit that it is not genuine butter, but I told you at the time what you were buying; I gave you notice." Those are two entirely separate defences.

10338. Still the question would arise, what is genuine butter?—Your standard fixes that.

10339. Our standard only fixes where *primâ facie* the presumption arises that the butter is not genuine. Take this case: Suppose a seller says to an inspector, when he is taking a sample: "I call this genuine butter, but milk has been added to it, and consequently it contains 25 per cent. of water," is that a sufficient disclosure?—It would be a question for the magistrate whether, in his opinion, it was a sufficient disclosure, and whether the purchaser had notice that he was not buying a genuine butter.

10340. Surely a disclosure which discloses, beyond all possibility of misunderstanding, all the facts must be a sufficient disclosure?—I should think that it would be myself. If you ask me, personally, what I should find in the case on the question of fact, I should find that there was a sufficient disclosure.

10341. That deals with the first question I put before you; then comes the question of genuineness: How would you deal with that, under the facts as I have stated them?—The question of genuineness does not arise here, because you have not bought butter; you have bought butter and milk, or butter and water, or whatever it may be. There is no question of genuineness arising there, and the man does not plead that he sold you genuine butter.

10342. He has sold what he calls "milk-blended butter"?—Yes; but you must understand that when he uses the words "genuine butter," in that connection he gives you his definition of genuine butter, and you know it is not really genuine butter, but that it is butter and something else—in other words that it is adulterated butter.

10343. (*Mr. Dunn.*) If the disclosure is sufficient, the whole case ends?—That is so.

10344. (*Chairman.*) Supposing he discloses the fact that he found it more economical not to take too much trouble about making his butter, and that he found it easier to leave 20 per cent. of water in the butter than 16 per cent.?—If he left his statement there, that he had found it easier to leave 20 per cent. of water in his butter, I doubt whether that would be a fair notice to the purchaser.

10345. But still he would have disclosed all the facts, would he not?—If he said: "This is butter," and he only made a sort of general statement to the purchaser that he had found it easier to leave a certain amount of water in the butter; then it would be a question of fact for the magistrate trying the case to say whether that was a sufficient notice to the purchaser that the particular sample of butter which he was buying contained more water than the 16 per cent.

10346. Is it a fair question to ask you whether you consider that the law and the regulation, as it will stand in two days' time, is in a satisfacory condition?—Very much more satisfactory than it was. I think fixing the standard, if I may say so, will be a very great improvement. One was always met before, when an analyst's certificate was put in, with the suggestion, "This analyst is a crotchety fellow; he takes a very high and ridiculous standard," and that sort of thing. But all that argument really falls to the ground now, because you has got a standard fixed by gentlemen who have thoroughly considered it, and it is no good one suggesting that now. I think, myself, that the standard will be an excellent thing.

10347. (*Mr. Dunn.*) The standard fixes the point at which the onus of proof is shifted from the prosecution to the defence?—Certainly, and makes it very difficult for the defendant to prove the contrary.

10348. (*Major Craigie.*) On the question of procedure, as these case we have been referring to are all cases conducted entirely under the Food and Drugs Acts, are we to take it that you would not regard any evidence, except the evidence received directly from the analyst who analysed the sample, after the standard was fixed, as to the percentage of water or the percentage of any other adulterant in the butter? He having stated a certain figure which was within the standard, would that satisfy the Court, even if other evidence was tendered of an act of actual adulteration?—No, I think not, if evidence was tendered of an act of actual adulteration.

10349. You observe my point—namely, whether the statutory standard would cover an act of adulteration, which still left the butter an article which complied with the standard?—I do not think the standard would protect him in such a case.

10350. It has been suggested to us, as regards a standard for other things than water in butter, that there might be a levelling down as a consequence of the standard?—Probably that would require a decision of a Divisional Court to decide it. If he could show that the butter came within your standard, that is to say, contained only 15 per cent. of water, I myself should have thought, if a witness were called who said: "That may be so, but I tell you I saw this man adulterating his butter"—forcing water into it if you like—and if such a statement as that were proved, that the vendor would have rendered him liable for selling adulterated butter. I presume that such a thing might be the case where the butter in its natural state had a very small percentage of water, and the vendor thought that he might put more into it, and still keep it within your standard.

10351. But that would not apply in cases where notice had been given to the purchaser?—Notice is, I think, a separate defence altogether.

10352. As a matter of fact the only offence under the Act is the selling of something to the prejudice of the purchaser, that is, selling something which is not of the nature or quality demanded by the purchaser. The word "genuine" in Section 4 of the Act, and in the regulation might be held to mean of the nature and quality demanded, and in the case of butter, which is a manufactured product, unlike milk, which is a natural product, a butter which is not genuine might be construed to be something which is not demanded by the purchaser. Would you so construe that word "genuine"?—I do not quite know that I follow the point.

10353. The genuineness of an article, which is not a manufactured article, would be its trueness, if I may so say, to the normal type; but in the case of butter, which is a manufactured article, and must therefore consist of much greater varieties, say, than milk—would the point that would weigh with the Court in deciding whether this was genuine or not, be whether it was what the purchaser expected to receive under the old section of the Act of 1875, and whether it was commonly received in the trade under that name?—Yes, I think so.

10354. That would be an element in deciding the case, would it not?—I think we should have to consider that.

10355. Strictly the use of the word "genuine," with regard to a manufactured article may be open to a little question?—Yes. I am putting a question to you—though, perhaps, I ought not—Does not "genuine" in the case of butter, mean "butter made from milk with the cream or from cream"—and made in the ordinary way?

10356. (*Professor Thorpe.*) And subsequently or not subsequently manipulated—that is the essence of the whole point?—If it is subsequently manipulated, I should not call it genuine butter.

10357. Let us put a concrete case. Take a certain sample of colonial butter, which we say is imported into this country with 8 per cent. of water in it, which is very much below the standard prescribed by the regulations. A manufacturer of butter goes to work, and by a machine incorporates an additional 8 per cent. of water. Would you consider that the purchaser is prejudiced thereby?—I do not know that that has ever been decided, and probably a case would be taken to the Divisional Court upon it, but I should say that that was adulterating it.

10358. (*Chairman.*) Although the seller disclosed the fact that he had added 8 per cent.?—No. If he made his disclosure, that is a separate matter altogether; but I was keeping clear of that. On the question of whether it was genuine butter, I should say that he had not sold genuine butter, but he had sold butter which had been adulterated—which was a high class of butter, if I may so call it, which had been let down by the addition of water.

10359. (*Professor Thorpe.*) A similar case has been fought out, and there have been difficulties. We have had evidence before this Committee of the analogous case of milk. You are aware that in the case of milk the Board of Agriculture has prescribed regulations as to what milk shall contain in regard to fat and non-fatty solids. The effect of those regulations may be to create, so to say, a standard of quality of milk, and it might be interpreted that a purchaser had no right to expect milk of any higher quality than is indicated by the standard?—I do not agree with that. I think the purchaser has a right to expect a *bonâ fide* article. If it is a good quality of milk, then he gets the benefit of that. It is open to the seller to charge more for it if he has got a particularly rich milk. If he adulterates it, and lets it down with water, he is not supplying milk. If the purchaser asks for milk he is entitled to have the real article—not milk and water. The seller's difficulty would be there, because he would have sold him milk and water.

10360. Would you have any difficulty in convicting in a case like this? Supposing a certain sample of relatively rich milk had been let down by the addition of skimmed milk at a railway station where the milk was received?—You are keeping the question of notice entirely on one side.

10361. That is so. Supposing a sample of rich milk was received at a railway station, and an employee of the person vending the milk was seen to pour into that milk a certain proportion of skimmed milk; an inspector took a sample of that milk, and brought it to the analyst, and the analyst found that the amount of fat in that milk was still 3 per cent.—that is, was still up to our standard; nevertheless, if the evidence of the admixture of skimmed milk was satisfactory to you, I presume you would have no hesitation in convicting?—No. There is, however, a little difficulty about that, because there is the case of Lane v. Collins (I think that was the name), decided some time ago, where a man went in and asked for milk, and they supplied him with skimmed milk. It was held, I think, by Mr. Justice Mathew and Mr. Justice Day, that he had got what

Mr. E. N. F. Fenwick.

2 May 1902.

he asked for, namely, milk. He did not ask for fresh milk; he asked for milk, and, though he was supplied with milk which had been skimmed, it was held that he had got what he had asked for. I am not quite sure how far that would be followed now. It is not for me to suggest that they made a mistake, but there is the little difficulty that that case is, I believe, still not over-ruled—at least, directly.

10362. A man requires to be more specific in his demand?—Yes. If he had asked for fresh milk, they said, in that case there would have been an offence, but he went into the shop and asked for milk, and the man supplied him with skimmed milk, and the judges said he had got what he asked for, viz., milk, and you could not call it anything else but milk.

10363. In these days, if he asked for fresh milk, inasmuch as the cream may have been taken off by a separator, the milk might still be fresh?—Would you mind altering your statement, and saying that a man went to Spiers and Pond's and asked for fresh milk, and then was supplied with fresh milk let down with skimmed milk, but still containing the fats up to your standard. I think that would be an adulteration.

10364. You are aware, of course, how Spiers and Pond get themselves out of that possibility?—I think I remember myself having one of those Spiers and Pond cases, in which they had marked their tumblers and put a notice on the counter; in fact, they got out under notice.

10365. They had made a sufficient disclosure in that case?—Yes, they had given notice to the purchaser. That is the way they slipped through it—because they could not rely on their warranties.

10366. (*Mr. Gibbons.*) Supposing a man received two churns of milk—one of which contained only 2½ per cent. of butter fat, and the other of which contained 4½ per cent. of butter fat—then mixed the two together, and thus brought all the milk up to the desired standard; I presume you would not fine him?—No, I think not, because he is not adulterating; he is dealing with two genuine samples of fresh milk and mixing them.

10367. May I ask if, in your opinion, it would not simplify this matter very much, and be for the benefit of the public and fair to the trade, if it were enacted that any butters sold which contained over 16 per cent. of water, or which contained other fats than butter fat, should be sold under some other name than that of butter?—That is a matter I have not very carefully considered, and I should not like to express an opinion upon that. I am sure you gentlemen are much more competent than I am to deal with that question.

10368. Would it not simplify the matter very much if that was enacted?—So far as the proceedings in court are concerned, certainly it would.

10369. (*Chairman.*) If a consignment of the 8 per cent. butter, to which Professor Thorpe has alluded, and, I believe, which is generally colonial butter, were purchased, and half of it was adulterated with water up to the 16 per cent. standard, and the other half was brought up to that standard by addition of milk, would you deal differently with the two cases? You have told us that in the case of water you would say that the article was adulterated, but in the case of milk, as I understand you, the butter would be genuine, or else it would not be considered as butter, because it was altogether a different product?—It is let down in the one case by water, and in the other by milk. I should deal with them both on the same footing; they are both adulterations.

10370. Would that not decide the case of Pearks, Gunston, and Tee's butter?—The case of Pearks, Gunston, and Tee's butter went off on the ground of notice. Both the addition of the water and the addition of the milk would be adulterations, of course.

10371. If notice were given in both cases, what then?—Then the seller would be entitled to his acquittal.

10372. Even in the case of added water?—Yes, if he gives notice.

10373. Do you attach no importance to the word "genuine"; if notice is given, does the question of the genuineness of the butter disappear?—It does not arise; in fact, giving notice assumes that the article is not genuine, because the man says "This article is not genuine, and I tell you so."

10374. (*Major Craigie.*) He takes it out of that part of the statute?—He takes it entirely out of Section 6, which is the section creating the offence.

10375. Is there any other section which it could be brought under? I think there is only Section 2 which introduces the words "injurious to health"?—Except it be injurious to health, I do not know that there is any other section that it could be brought under. There is Section 9, which deals with abstracting butter fats from milk; that is to say, not watering milk down, but absolutely abstracting the butter fats, which is rather a different case. It was suggested in that curious case of Lane *v.* Collins that the prosecution there had made a mistake, and that they ought to have taken their proceedings under Section 9 for abstracting the butter fat, and not under Section 6 for selling something other than the article demanded.

10376. (*Professor Thorpe.*) That they should have brought the proceedings on the ground of the impoverishment of the article?—Yes. That was suggested. Probably the seller would have had no answer if they had charged him under Section 9 with abstracting the butter fats, because he had skimmed his milk and taken the butter fats out of it.

10377. (*Major Craigie.*) Has your attention been called to another case which has been recently decided in the lower courts, and I think also in the higher court, which turned on the point whether butter made in the fashion which has been described here to-day could be brought under the Margarine Act as not being butter, but legally margarine?—I did see that case in the newspapers, but it was so abominably reported that it was rather difficult to understand. It has not been reported yet in any of the regular Law Reports. That was a case where butter was adulterated, and then they charged the man with selling margarine containing more than 10 per cent. of butter. I think it was a Pearks' butter case.

10378. That was tried under the 8th section of the Act of 1899. Have you had a case in which that point has been discussed?—No; the only case I can recall is the Spiers and Pond milk case at the railway station, which I mentioned just now. I do not recollect that I have had any of these what you might call fancy butter cases. I have read the cases from time to time as they came on; I take an interest in them, because I may be called on any day to decide them.

10379. I think we may take it from your evidence to the Committee that your general opinion is that the law has been improved in its working by the issue of a regulation under Section 4?—Very much, in my opinion; I think it is a great improvement.

10380. Are you of opinion that, for want of a standard, there have been serious omissions to convict in cases where convictions ought to have been had?—No; that has not come to my knowledge, but I have known dreadful wrangles as to whether the analyst was reasonable. Before that standard came, the analyst always had to make a standard of his own; when he said, "This is deficient in butter fats so much," he had to assume some standard by which he could measure it. The standard that he fixed I daresay was a standard more or less agreed upon by all public analysts. I do not know how far that was the case, but it always raised a wrangle as to whether it was a reasonable standard. The defence said, "This man is a crochetty man, who has fixed an unreasonable standard, and you cannot rely upon it."

10381. Then you are not of opinion, like some of the witnesses before us, that a standard is not of much value, because, by giving this notice that we have just been discussing, a seller can always escape the standard?—They will not give the notice. These cases mostly occur in the poorer districts. Poor people get no notice. They go in and ask for a quarter of a pound of butter; no notice is given to them, but the article is handed to them over the counter. I do not know why a tradesman should be convicted if he only behaves fairly and honestly. If you ask him for butter, and he says, "I tell you that I do not sell genuine butter at my shop; I give you notice what I am going to sell you here; it is very good stuff, and I daresay you will like it, but it is butter, we will say, with 30 per cent. of water in it; that is, it is water and butter."

10382. (*Mr. Hickey.*) Supposing he sold different kinds of butter—genuine butter conforming to the 16 per cent. standard, and also butters, as most of these people do, which contain from 20 to 22 per cent. of moisture?—Then if he likes to draw the attention of the customer to it, I do not see that he is doing any harm.

Mr. E. N. F. Fenwick.

13 May 1902.

10383. Then he may sell various kinds of butter, those which you would call genuine and those which you would not call genuine, if he makes a disclosure?—As Pearks, Gunston, and Tee, for instance, sell theirs.

10384. But they sell nothing else?—It was so in that case which Mr. Gilchist mentioned. That was only really material when you came to consider the question of notice stuck up at the back of the shop. If the notice is given by the shopman when he sells the particular sample—if he says, "I sell all sorts of butter, but this that I am going to sell you is butter with 30 per cent. of water in it," then that is sufficient notice.

10385. And if it is put up in a wrapper bearing words of a similar character to those contained in the notice?—If the wrapper states that the butter contains 30 per cent. of water, or whatever it may be, then I see nothing fraudulent in that.

10386. (*Chairman.*) Have the London police magistrates got any organisation to confer as to the practice to be adopted in cases of this kind, with a view to establishing, if possible, a uniformity of procedure?—Yes; we have quarterly meetings at which we discuss all these matters. The difficulty in these matters is that when you come to look at the case before you, you will find that it turns on a question of fact, and you cannot get magistrates or anybody else to agree upon facts. I once had the honour of sitting with a number of magistrates, when I was at Bradford, before I came to London. My brother magistrates on the bench and myself used to retire sometimes, and it was perfectly extraordinary, on an issue of fact, the number of different opinions there were about it. I would retire with three gentlemen, and they would all hold a different view upon the issue. "I think so and so," "I think he did," "I think he did not." We arrange things as far as we can, and talk those things over and discuss them; but you cannot arrange to decide issues of fact beforehand.

10387. The effect of the operation of the regulation that has already been made, and of any further regulations that may be made under our reference, may be a subject for discussion before such a meeting?—Undoubtedly; when you have made the regulation, I have no doubt that it will be brought before one of our quarterly meetings.

Dr. William Hampton Wray, called and Examined.

Dr. W. H. Wray.

10388. (*Chairman.*) I understand that you are inspector in charge for Great Britain appointed by the United States Department of Agriculture (Bureau of Animal Industry)?—Yes.

10389. Will you kindly tell us exactly what your functions are in this country?—The inspection of live cattle and refrigerated meat. We keep control over them from start to finish—you might say almost from the producer to the consumer. It is rather a long history; I do not know whether it would interest you.

10390. I do not think it will be necessary to go into that. Are you officially connected with the butter trade in any way?—Only when they send me a special notice. In 1897 we made several experimental shipments of butter which I handled here for the department. The department gave directions to different creameries in different sections of the United States as to how they wanted the butter made, and they sent inspectors to see the butters made and to superintend the whole *modus operandi*. That was marked—tagged, so to speak—and a description of it sent to me, and I met the steamers that the butter was on, took the temperature of the cold storage rooms, then put it on the market here, and then made a report.

10391. Have you any expert knowledge of butter making?—No, I have not.

10392. Has that been your only connection with that particular product?—That is all.

10393. Have you any recommendations to make with regard to the expected imports of butter from the United States which are relevant to the inquiry before this Committee, whose reference, I presume, you have seen?—I do not think I have any recommendations to make, simply because we would be willing to abide by whatever decision the Committee came to, and would try to assist you in every way possible.

10394. You have seen our decision as to water in butter, and you know of the regulations which are coming into force on the 15th inst., I believe?—Yes, we have certain laws in the United States that will not allow above 12 per cent. of water, and they wished me to see the secretary of your Committee and ask whether you could not adopt that standard instead of the 16 per cent. that you have adopted. They seem to think that you allow too much water.

10395. To which States do you refer?—The Federal Government has lately passed a new Bill, a copy of which I have here, and I have also a copy of the National State Dairy Laws and the circular letter relating to this subject. (*Handing in the same.*) We have different State laws in the United States. Each State has a Government of its own—home rule, so to speak—a State Legislature and a Governor. They have authority to pass any law that they think fit, so long as it does not interfere with the Constitution of the United States. The only way the Government can control the quality or the standard of butter is to work under what they call the Inter-State Commerce Laws—in other words, not to allow a spurious butter to go from one State into another, or for export. The Bill was passed for that purpose, and the circular letter was sent to the different creameries and to the different dealers in butter, stating that if they wish to export butter they can have it inspected and chemically analysed, and a score-card supplied them which they use over there. I have not much faith in the card, because it is merely based on taste. Anyone inclined to export butter can have it inspected by Government officials free of charge, and then it would be marked and stamped by the United States Department of Agriculture as pure butter.

10396. Is that system already in operation?—Yes; it is in operation now.

10397. Have you been instructed to recommend to this Committee that the United States certificate and stamp should be accepted by the importing countries?—Yes, they wished me to ask you to recognise that certificate if you could.

10398. You are aware, of course, that it would be difficult to recognise the certificate of one country without recognising similar certificates from other countries?—I am perfectly aware of that, especially if other countries would not pass a suitable law.

10399. It is improbable that you would have uniform laws in all butter exporting countries, is it not?—Yes, I have no doubt that is where the difficulty would come in as far as you are concerned.

10400. Would it not be a wise course for countries wishing to establish the system that you are putting into operation in the United States to confer together with the view of getting a uniform procedure adopted by all such countries?—I am afraid that would be a very difficult matter. It would mean an international meeting of the different law makers of the different countries. I think the only way would be for you to pass whatever law you see fit, and to make all other countries comply with that.

10401. Supposing that this country were to lay down certain conditions which should be observed in giving certificates or in affixing stamps or brands, do you think the United States would make their law conform, if it does not do so already, to such regulations?—I think they would be pleased to do so. The reason I say that is because when your law was passed, some time ago, with regard to the shipment of live cattle, we practically made our laws the same as yours in regard to the fitting out of steamships, so that there should be no hitch and no difficulty.

10402. (*Major Craigie.*) With reference to the proposed stamp that you are speaking of on imported butter, you are referring, are you not, only to the examination of the butter by the Customs of the importing country at the port of landing?—Yes; but

Dr. W. H. Wray.

13 May 1902.

they would not bear the Government stamp unless they were examined.

10403. Having been examined on your side, is it your suggestion that an alteration of our existing legislation should be effected, so as to enable that butter to escape examination by the British Customs? —Not particularly to escape the Customs examination, but that you should recognise it as pure butter.

10404. I am referring to the Customs examination under Section 1 of the Adulteration of Foods Act, 1899, and not to the examination for duty, if there were a duty, which there is not at the moment?—We would like them to recognise our stamp, or, in other words, to declare butter with our stamp pure butter.

10405. That is the object of your having the stamp? —Yes.

10406. You do not suggest that the butter itself could be followed into the interior markets of this country?—No.

10407. When once the butter has passed out of the hands of the importers into the hands of the middlemen or the retailers, your stamp would, of course, be of no effect?—That is so, and we would not wish it to be otherwise.

10408. The butter might be manipulated or used for any other purpose after that stage?—Yes.

10409. Therefore, your suggestion is limited to the inspection of the butter at the ports?—Yes; it is the same way with the beef. We guarantee the refrigerated beef, and there is a Government stamp from our Department on all of that; but after that meat reaches Smithfield market, or even after it is landed off the ship, it is largely sold as best English and best Scotch. The same way with the butter; they might do nearly anything that they pleased with it, unless you have some law to control it.

10410. (*Professor Thorpe.*) Surely, if you have taken pains on your side to authenticate the character of the butter you send over, you would welcome some system which earmarked that butter till it found its way to the consumer?—Yes; if you could possibly do that we should be pleased, and in every way possible we would try to assist you; that is, as far as putting a suitable stamp on, and, if possible, putting the butter in small sealed vessels.

10411. (*Mr. Hickey.*) What is done with regard to the purity of the butter exported to England—does your Government take any steps to authenticate the purity of the butter shipped to England?—Only when an exporter states that he wants it to be inspected.

10412. An American exporter do you mean?—Yes, or any importer might make the request here.

10413. Is there a large quantity of American butter coming into England at the present time, which is adulterated with foreign fat?—No, we do not allow any adulteration in America. You will find that the different State laws will not allow any adulteration. Some States at the present time have no law.

10414. Are you in a position to say that the American butter which arrives in England now, and has been coming over here for the last twelve months, is all pure?—Yes; if it is marked pure butter, it must be, if shipped from a State which has a law.

10415. Do you know it of your own knowledge?—Not of my own knowledge.

10416. Can you give any official authority to the statement that all American butter imported into England is pure butter?—No, I could not, because, possibly, some might be adulterated.

10417. Do you know what process butter is?—Yes.

10418. Is that pure?—Pretty nearly.

10419. But not quite?—Not quite.

10420. Are you aware that large quantities of it come into London and into Liverpool from time to time, which have been proved to be adulterated with foreign fat?—No, I am not.

10421. With regard to the limit of water in butter generally in the States, 12 per cent. is your standard?—Yes, that is what they try to make it.

10422. Is that so right through the States?—Yes; in the majority of States which have any law.

10423. Is it the fact that they do not enforce that law, because they have found that it was too low a percentage to set up?—That I cannot tell you.

10424. (*Mr. Dunn.*) Apropos of what Mr. Hickey was saying, you have stated that the opinion in the States is that 16 per cent. is too much water to allow?—Yes, that is the opinion of the chief of our Dairy Commission, Mr. Alvord.

10425. Has he expressed that opinion?—Yes.

10426. (*Mr. Hickey.*) Could you tell the Committee what the general prices of butter have been in America, say, during the last six months, and what have been the prices of similar classes of butter imported into England from America?—I could not for the last six months.

10427. Are you aware that in America your butter has been selling there at 130s. and 140s. per cwt., while here pure American butter has been sold at 84s. to 88s.? —I know that that happens at certain times every year.

10428. During what months?—Generally, if I remember right, during March, April, and May.

10429. Is there any special reason why the butter should be so cheap then as compared with its price at other months of the year?—I suppose it is because they manufacture it then more largely, as there are more calves being born, and more milk during that time of the year.

10430. They do not want to consume it at home; is that it?—Yes. I know that during one of these experimental shipments of butter that was shipped over here in 1897, the price was so low here, as compared with the States, that we shipped it back again. That butter came across the ocean, I reshipped it, paid the freight both ways, and it made more money in New York than it would have made here.

10431. (*Mr. Gibbons.*) Are your butters examined with regard to any other substances than those of water and animal fats?—Yes, they are examined in reference to chemical preservatives as well.

10432. I think you said that the butters exported were only examined at the wish of the exporter?—Yes.

10433. Then any exporter who was sending us butter not pure would not, I suppose, ask for it to be examined?—Very likely he would not.

10434. Therefore, we have no guarantee that your butters are pure?—No, unless they have the Government stamp on them. We are willing, if you make that suggestion, to try and compel all exporters of butter to do it. That is the object of the Bill I have laid before you; it is the entering wedge to compel all exporters of butter to have it examined by Government officials.

10435. At present they are not compelled?—That is so; the butters are only examined by the State officials when requested.

10435*. Can you guarantee that there is no margarine mixed with your butters that are exported here?—No, I could not say that.

10436. (*Mr. Gilchrist.*) Except when the stamp is on? —Except when it bears the Government stamp.

10437. (*Mr. Gibbons.*) Would you be sure that those butters which bear the Government stamp contain no margarine?—I should.

10438. Can they detect the presence of margarine?—I should think so.

10439. Could they detect 10 per cent. of margarine?—It would be a difficult matter to detect 10 per cent. possibly, but you could detect more than that.

10440. Could you detect 15 per cent. of margarine? —I should think that a chemical analyst could do that. I am not much of a chemist, and I do not know; I am only speaking now from general ideas.

10441. (*Professor Thorpe.*) It is said in the circular letter from the Secretary of Agriculture, which accompanies this order from the United States Department of Agriculture, that, "The inspectors do not classify nor grade the products, but they determine first, in all cases, the question of purity, and then that of quality expressed in general terms, with special regard to the suitability for export or shipment to a distant market. Consideration is also given to the known requirements of the particular market to which the products are to go." That rather suggests that you have a variable standard in the matter of your produce?—Yes. I presume there would be.

10442. What does that mean precisely when you have a variable standard; what is the difference, then, between one butter and another butter?—I do not think that means a variable standard in a broad sense, although possibly it might. I think the idea is that at different times of the year butter is liable to vary, and, with butter going a certain distance at certain times of the year, they would want it more solid than at other times. Possibly, that is what they mean by taking those things into consideration.

10443. Would it mean, for example, a different amount of water in the butter?—No, I should not think that.

10444. And would it mean the possibility of the admixture of foreign fat?—No, because that would come under the Adulteration Act.

10445. But your Adulteration Act does not necessarily cover your export work, does it?—No.

10446. Your Adulteration Act is an internal Act?—Yes.

10447. Therefore, your Adulteration Act will not cover cases of exported produce?—Yes.

10448. Does it?—If anybody took that sample out and happened to catch them, yes. It would cover anything; you could not move it then—they would seize it.

10449. Although it was going to leave the country?—It does not make any difference where it is going. It is the same as with adulterated milk. The inspectors seize the milk—they make a raid on the railroad stations in the morning where the milk is coming in; they seize it, and if it is not up to the proper standard they will dump it all down into the gutter.

10450. But that milk is for internal consumption. Supposing it were being tinned and sent over here, what would happen then?—It would be treated in the same way if they happened to see it.

10451. Then I notice in the Order No. 91, issued by the Secretary, that Clause 6 reads as follows:—"The inspector shall mark only such products as he finds to be pure and merchantable, and of a quality and grade at least equal to the minimum standard to be prescribed for the product concerned from time to time by the Secretary of Agriculture." That also suggests a variable standard, does it not?—I think, possibly, that they are trying to improve the standard. I know we did think at one time that 16 per cent. of water should be allowed, and now they have got it down to 12 per cent. I think, therefore, they are trying to improve the general standard.

10452. Do you think this phraseology is in view of a gradual improvement?—Yes. That is an entirely new law. We have never had any Federal Government inspection of butter previous to that, and I think they were afraid to make it too stringent—they were afraid people would fight against it through our politicians, and that possibly they might not be able to do anything.

10453. What are your standards at the present time?—We have to go by the different State laws, and the standards may differ in the different States.

10454. Then, are we to understand that the butter, which may be sent over from the States, may not be of a uniform character?—It must be if it passes the Government control, no matter what the State law is.

10455. What does the Government control insist upon as regards standards of purity—for example, what particular amount of fat, what particular amount of water, and what particular amount of salt?—I suppose they would be based on those shipments that they did send. They would have about 12 per cent. of water and 86 to 87 per cent. of fat.

10456. You have accounted for 99 per cent. already?—I know it is a pretty strong percentage—then there would be about 1½ or 2 per cent. of salt, according to the taste.

10457. And nothing to be allowed for the curd?—I will take one sample from Connecticut. That had 9·3 per cent. of water, 87·3 per cent. of fat, 1 per cent. of curd, and 2·4 per cent. of salt. In that sample the ash was included in the percentage of salt.

10458. Is this regulation which you have brought before us now in operation?—Yes, it is.

10459. Do I gather from that that American butter never contains boracic acid, for example?—Not now; mind you, there has been some American butter shipped over here that has not been—I was going to say, fit for axle-grease, let alone consumption as butter. That is the reason we sent these experimental shipments over, and that was the commencement of the Government taking hold of it; our butter got such a bad name in the London market that we felt we must do something.

Dr. W. H. Wray.

13 May 1902.

10460. If we, in the Government laboratory, are constantly finding the presence of boracic acid in American butter, and aniline colouring matters in American butter——You might get colouring matters; I will not say that you will not.

10461. How is it they have escaped the operation of this regulation?—You may have got that butter before the regulation was in force.

10462. Such butters are coming in now?—You must recollect that the butter is not inspected unless the exporters ask for it.

10463. (*Mr. Gilchrist.*) The inspection is optional?—That is the idea.

10464. (*Professor Thorpe.*) Can you tell us what proportion of your exporters are coming within the operation of this regulation?—I could not.

10465. Would it be any large proportion?—I could not tell you.

10466. You have no means of knowing?—No, you would possibly have better means of ascertaining than I would, by seeing whether any of it came with the Government stamp on it.

10467. We should not see that in my laboratory; what we do see is the evidence of the boracic acid and of the extraneous colouring matter, and certainly rather more than 12 per cent. of water?—That is what they claimed on some of the analyses we had here, that there was too much water; but we could not make it out so by our analyses on the other side. We had analyses made over there, and we could not make out any more than the 12 per cent. Whether the refrigeration would add water to it or not—would increase it, that is—I do not know; I suppose it might.

10468. We may take it, I suppose, that it is the desire of the Department to bring the butter exporters, as far as possible, within the operation of this regulation?—Yes.

10469. They would welcome anything which tended in that direction for the good of the commerce of the country, I suppose?—Yes, they would; and any recommendation that you would make, I believe, they would be pleased to accept, and do all they possibly could to assist you in carrying out.

10470. (*Mr. Gibbons.*) Is there much difference in our markets here between the prices of American butters that bear the Government stamp and those American butters that do not?—I do not think you ever had any that bore the American stamp until the present time.

10471. You said just now that in certain cases your butters were exported bearing a Government mark or stamp?—They were experimental shipments.

10472. Do they carry any higher value in the London market than those that have not that Government stamp?—No; they held their own, as far as price and quality was concerned. I got 110s. per cwt. for some of them—the same price that the best Danish was selling for at the same time.

10473. Would you say that, as a rule, it has not paid the exporters to have their butters examined by the Government, and to have the Government stamp affixed to their butters?—They have not tried it.

10474. How long is it since the question was adopted?—It is quite a new Bill.

10475. (*Chairman.*) I see that the notice is dated the 15th January of this year. The butter has been sold on its merits, as I understand?—Undoubtedly; some would bring a low price, and some a high price, according to the quality of the butter. A man would taste it, and probably he would not care whether it was Danish, or United States, or American, or whatever it was, and he would pay according to the quality. I wrote to the Secretary of Agriculture, and asked him to send me a number of those circulars, and told him in the letter that I would take pleasure in sending them to all the butter dealers in England, so if our people were not inclined to have an inspection, the importer could insist upon it; in other words, he might say he would not have anything to do with American butter unless it bore the Government stamp.

10476. (*Major Craigie.*) He would ask for that particular blend of butter with the stamp?—Yes; or else the commission agent here might say "I do not want any American butter unless it bears the Government stamp; I want a guarantee of its purity."

10477. Are you aware that the total quantity of American butter coming to this country is very small indeed as compared with the quantity of butter coming

Dr. W. H. Wray.

13 May 1902.

from other countries; namely, 150,000cwt., as compared with 3,000,000cwt., which is only about 4 per cent. of the whole foreign butter imported?—Yes, I am aware of that.

10478. The American butter trade is not an increasing trade?—No, I do not think it is.

10479. Do you attribute that to the uncertainty that has hitherto existed in regard to the quality?—Yes, and I think you will receive less of it now, on account of the scarcity of cattle.

10480. Do you attribute the whole of the small size of the American export to that factor—the uncertainty of its quality?—No.

10481. Would you not rather say that, as the number of cows in the United States returned as dairy cows shows so small an increase between the one census and the other, that the consumption of the American people themselves of butter is taking all the surplus that you have?—There is no doubt about that.

10482. That may probably explain the very small export?—Yes. Then again, the United States is a new country as compared with Denmark. Our dairying districts are just about waking up as to the proper manner and proper method of making pure butters. Dairies have been established in the different farming sections, and they have been properly equipped with an expert and a chemist, and they are going ahead.

10483. (*Mr. Gibbons.*) Do I understand you to say that your cows are much scarcer in America than they have been?—Yes, we had a very big drought last summer.

10484. Is that the reason you shipped less butter?—Yes.

10485. Will that also extend to cheese?—Yes.

10486. We shall have very much less cheese then?—Yes; and less beef and less cattle. We are 30,000 head of cattle short in the first four months of this year as compared with last.

Professor Dr. VON BUCKHA and Professor Dr. P. VIETH (accompanied by Dr. H. GERLICH, of the German Embassy), called; and Examined.

Prof. Dr. von Buchka, Prof. Dr. P. Vieth, and Dr. H. Gerlich.

10487. (*Chairman.*) (*To Dr. von Buchka.*) I believe you are a member of the Imperial Council of Health of Germany?—(*Dr. von Buchka.*) Yes, I am.

10488. And you appear here as a chemical expert?—Yes.

10489. (*To Dr. Vieth.*) I believe that you are Superintendent of the Dairy Institute at Hameln, and that you are also a dairy expert and a chemist?—(*Dr. Vieth.*) Yes.

10490. I believe that you both appear here as representing the German Government, and at the request of the Government?—Yes.

10491. Germany is interested in this question in connection with her export of butter to this country?—To some extent, yes.

10492. Have you agreed upon any recommendations that you would make to the Committee from the point of view of your own trade?—(*Dr. von Buchka.*) There has been a statement sent in to the Committee by the German Government on the subject.

10493. And you have come to give any information about the statement that we desire, and to support its recommendations?—Yes; we are quite ready to answer any questions you may put to us.

10494. The memorandum which your Government has sent us explains the state of the law as regards butter adulteration in Germany, and I think it appears from that statement that there is no official definition of butter, that its genuineness rests largely upon the evidence of chemists, and that chemists have agreed among themselves as to a certain formula?—That is not quite exact. The position now is that the Government has fixed a limit for water in butter, but nothing else.

10495. As regards the other constituents of butter nothing has been fixed?—That is so. I think we have a definition of butter in the Act of 1897 on the sale of butter. By that law it is prohibited to sell any article as butter whose content of fat does not come from milk. The article is only considered as butter when all its fat is fat which comes from milk, and if any foreign fat is added to the butter fat, then we consider it as adulterated or as margarine.

10496. But the law does not state what test shall be applied in order to ascertain whether there is any foreign fat, and if so, how much?—No; we have only this, that by Article 12 the Bundesrath has a right to say in what manner the analysis of butter shall be made, and that by Article 11 figures can be fixed for the content of water, fat, and sodium chloride. That has been done since the Act was passed, and we have had since the 1st of March a Bundesrath regulation stating that salt butter shall not have more than 16 per cent. of water, and that butter which is not salted shall not have more than 18 per cent. of water. The amount of salt that can be added has not been fixed.

10497. A great deal of evidence has been brought before this Committee to show that butter with a large percentage of salt in it carries a larger percentage of water than butter with a small percentage of salt in it?—The question of the amount of salt will certainly be regulated at some future time. The Government has now the intention of regulating it.

10498. I do not think you quite understand me. You have told the Committee that in Germany you allow a larger percentage of water when there is no salt than when there is a considerable amount of salt, and I stated that the evidence which has been produced before us is all in the opposite direction, namely, that butter with a large percentage of salt must necessarily carry a larger percentage of water?—The reason for our regulation is the following, I think: Generally the butter which is exported is salted, and in that case we think its composition should be 80 per cent. of fat, 16 per cent. of water, and 1 per cent., I will say, for the ash, for the proteids, and for the small quantity of milk sugar, which makes 97 per cent.; and then we assume that only 3 per cent. of salt will be in the butter. Butter which is unsalted is not produced for export. The unsalted butter is produced in the southern parts of Germany, and one finds there that if we have 18 per cent. of water and 1 per cent. of ash, milk sugar, and proteids, then there remains 81 per cent. of fat. The unsalted butter, therefore, will have a greater quantity of fat than the salted butter, and to that extent will be a better butter than the salted butter; for this reason we have conceded that the unsalted butter may have 2 per cent. more water than the salted butter. I think there is no reason for assuming that salt butter should necessarily have more or less water than fresh butter. We believe it is possible for the trade to reduce the water to 16 per cent., whether the butter is salted or not.

10499. In short, you insist upon having 80 per cent. of fat in any case?—Yes, in every case.

10500. If you leave room for 3 per cent. of salt in some cases, then, where you have 3 per cent. of salt, I understand your point is that if you allowed more than 16 per cent. of water there would not be room for the 80 per cent. of fat which you must have?—That is so; the 80 per cent. of fat must be always there.

10501. (*Professor Thorpe.*) Your point is that the butter must contain at least 80 per cent. of real butter fat?—Yes.

10502. The odd 20 per cent. might be partly made up in the one case, where the butter is fresh, of 18 per cent. of water, but where the butter is salt, then the amount of water must be not more than 16 per cent., the residue being made up of salt and curd?—Yes, that is so.

10503. (*Chairman.*) Now, with regard to the tests which are applied for the ascertainment of foreign fats in butter; upon what tests do you chiefly rely?—We think that it is not possible to give a certain figure.

Prof. Dr. von Buchka, Prof. Dr. P. Vieth, and Dr. H. Gerlich.

13 May 1902.

10504. (*Professor Thorpe.*) How do you determine that you have got 80 per cent. of butter fat?—We always determine the water, the ash, and the sodium chloride, and the balance we take as fat. We have a Government law, which has to be considered in the analysis of butter, but we have not an enactment that the fat shall be determined directly, chemical experts having said that it was not possible to be quite certain in attempting to determine the fat directly.

10505. Are we to understand that you can give us no method by which you can guarantee that the 80 per cent. is what it pretends to be, namely, butter fat? Have you no method by which you can signify that it is genuine butter fat?—In the law I mentioned before it is provided that an analytical chemist shall see whether the butter consists of pure butter fat, or whether it is adulterated with other fats, and he must also see whether there are any vegetable fats in it. It is also provided that other adulterations shall be tested for. I think that science has not yet progressed so far as to enable us to ascertain every case of adulteration if the adulteration is effected by the addition of some other animal fat. We have to reckon with the possibility that vegetable fats, which have a smaller commercial value, are added to the butter, and especially margarine fat; and for those we have to test.

10506. Would you kindly set out more in detail for us, precisely how you ascertain that the fat is actually butter fat—the fat of the milk of the cow—and that there is no extraneous or foreign fat, either vegetable or animal?—The method mostly followed by analysts in the present state of the science is the Reichert-Meissl or the Leffman-Beam. We have it also enacted that the refractometer figure shall be determined, although we know that it is not a quite certain means of recognising pure milk fat.

10507. Are those directions to which you are now referring official directions to the analyst?—Yes. The official directions for making analyses of butter are published by the Bundesrath. These directions leave to the chemist the choice of the method to be employed. We do not say which method must be adopted, but we leave it to the chemist. In these regulations there are particular directions given for taking the refractometer figure and also for taking the Reichert-Meissl figure.

10508. From what authority does that decree or regulation emanate?—It is promulgated by the Bundesrath—that is, the combined Governments of Prussia, Bavaria, Saxony, etc. These regulations were promulgated on the recommendation of the Board of Health, to which I was for five years chief chemist.

10509. Does it come about thus: That the Board of Health lays down certain methods which can be applied to the analysis of butter, and a Minister accepts the responsibility on the advice of the Board of Health, and makes a regulation which is binding upon the chemists?—(*Dr. Vieth.*) It is not exactly binding; it is only an advice to the chemists to follow those methods. (*Dr. von Buchka.*) The regulations are based on the Act of 1897, regulating the sale of butter. Article 12 of that Act says that the Bundesrath has the right to publish laws respecting the analysis of butter. Acting under that article, the Bundesrath has promulgated this regulation. In the first place, the Board of Health has to consider these things, and they have heard a great number of chemists who are especially concerned with the analysis of food. Then the regulation is promulgated to the different Governments; they refer it to their analytical chemists, and then the Bundesrath, after hearing all the experts, promulgates it as law.

10510. Your method of procedure is somewhat similar to ours—that is to say, you have an inquiry not made by a Departmental Committee precisely, but by a Board, the Board of Health, and they take such steps as they think fit to inform themselves upon the matter. The analysts advise them, and when they have considered these opinions, then they advise the Minister as to what regulation shall be issued; is that not the case?—Yes.

10511. In other words, your Board of Health takes the place for the moment of this Committee?—Yes, that is it. (*Herr Gerlich.*) It is not the Minister who promulgates it afterwards, but it is the Bundesrath, which is the representative of all the confederated Governments.

10512. Nevertheless, some Minister takes the responsibility?—In Germany each Government is supposed to be quite independent, and we are represented by the Bundesrath.

10513. (*Chairman.*) Like the House of Representatives at Washington?—Not like the House of Representatives, but like the Senate, rather. (*Dr. von Buchka.*) It is promulgated by the Chancellor of the Empire.

10514. (*Professor Thorpe.*) He takes the responsibility?—Yes. (*Herr Gerlich.*) We have Home Rule; each Ministry is independent.

10515. The Committee has gathered, I think, that the Board of Health has taken evidence or got information as to what methods are available for the analysis of butter-fat, with a view to its authentication, and then the Board of Health have described in the document before you certain processes which are available, and which chemists may make use of in order to enable them to certify the genuineness or otherwise of samples of butter?—(*Dr. von Buchka.*) Yes.

10516. Would you kindly explain again what criteria of purity or authenticity they have laid down as the methods which chemists may make use of?—They have adopted a great number of different methods of analysing butter. It is not only a question whether the butter-fat is pure, but we have also to ascertain the quantity of water and the quantity of ash. We have also to test for preservatives. The regulation first suggests in what manner we should estimate the water, and then the proteids, the sugar, and the ash. Then we are told how the preservatives, boracic acid, salicylic acid, and formic aldehyde, may be determined; but those are things that we do not very often find. Afterwards we are told how we can determine the melting point and the freezing point; I know that these have no very great importance, but in order to make the analysis complete we have to take those things into consideration. Then follow directions for the determination of the refractometer figure. We believe the refractometer figure will not help us much if the butter has only been slightly adulterated, but we think that it will help us where there has been very grave adulteration. In many cities, and in many of the confederated States, police officers take samples in the markets and from the different merchants, and test specifically for the fat by the refractometer. At Berlin, for instance, that is done. I do not think that they are able to detect adulteration in every case in which it is practised, and it will happen that they may think the butter has been sophisticated when really they cannot be quite sure; but it has been found in many cases that a police officer who has had great experience has discovered indications of sophistication which have been afterwards confirmed by the analytical chemist, and that is the reason why we still retain the refractometer test.

10517. Are we to understand that your procedure, then, is this—that the municipality employs the police to test the butter by means of the Zeiss refractometer?—It is not always done by the municipal police, for we have Government police in some of our States. In Bavaria, for example, the stations where the analyses have to be made are Government stations, and the rule is that the chemical assistants go into the different towns of their district and take samples. In Bavaria the assistants at the Government laboratories are not authorised to take samples for themselves, but they must take with them a policeman from the different communities, and so the police assist the chemist by taking the samples. Where the superintendence is in the hands of the municipalities, there the police also work it. At Berlin it is done neither by the Government nor by the municipality; there the President of the Police has to do these things. He sends his officers out into the town to take samples and to test them by the refractometer figure, and when they believe that a butter is adulterated they bring it into the laboratory, where it is analysed chemically. We have, therefore, allowed the refractometer test to be employed, but it is only regarded as a preliminary test, and at all times before taking proceedings it is necessary to make a chemical analysis.

10518. When the police officer or the person charged with taking a sample has reason to believe that the butter is wrong, does he take the rest of his sample to the chemical station, where it is fully analysed by a competent chemist?—Yes.

10519. Supposing the indication as yielded by the Zeiss refractometer is corroborated by the chemist, what further action is taken?—Then the Reichert-Meissl

Prof. Dr. von Buchka, Prof. Dr. P. Vieth, and Dr. B. Gerlich.

13 May 1902

method is adopted, so as to ascertain the volatile and soluble acids.

10520. The Reichert-Meissl or the Reichert-Wollny figure is then determined?—Yes. We have laid it down that the Reichert-Meissl figure can be ascertained either by employing an alcoholic solution, or, according to the Leffmann-Beam method, in a glycerine solution. We know that many chemists prefer the latter method.

10521. Are those alternative methods described in the regulation?—Yes; but the regulation does not prescribe standards.

10522. Does not the absence of standards lead to great diversity of opinion and of practice among the various analysts?—We know that many people would say that; but we have a means which may give some uniformity to the practice of chemists. Many of the chemists who have been regularly employed on food analysis ever since the year 1894 have met together under the presidency of the Board of Health, and they have agreed upon a great number of standards and of methods which are to be observed in analysing different foods. They have published three little books from which one can see what standards should be regarded in analysing the various foods.

10523. Has this association of chemists, who have banded themselves together to discuss and adopt standards, any official position?—No; but the Board of Health has worked in conjunction with the chemical experts; and although the work of this association has no official character, it is adopted by the greater number of chemists, and serves as a basis for any arrangements which may be made by the Government.

10524. Then, that association has no other official position than the Society of Public Analysts in London. It would be equally open for the members of the Society of Public Analysts here to meet together and arrange amongst themselves what standards should be binding upon them?—No chemists in Germany can be compelled to follow these regulations or to take the standards proposed here; but the judges will follow them to a great extent. I think I must add one point here which seems to be important. These regulations were originally published in the year 1897, and they have been adhered to since; but in the meantime the science of food analysis has advanced. For instance, in the chapter which gives the standards for butter, the Reichert-Meissl figure is put as ranging from 26 to 32. Since that was published, there have been great changes, and I think if we were to issue a new edition now, we should no longer take those very high Reichert-Meissl figures of 26 to 32. I might state that it is intended to re-issue it, and that the Council of Health, of which I am a member, will make it part of its duty to publish it. The Council of Health is a body which has been added to the Board of Health, and its duty is to give advice in all things of importance concerning the health of the community; and, as I say, it will soon proceed to the work of editing a new issue of these Vereinbarungen. Then, I think, the Reichert-Meissl figures will be revised, and that we shall take lower figures; for we now know from the Dutch butters, and from other samples, that it is not possible to remain at those figures.

10525. You mean that experience has shown that they are too high?—Yes.

10526. When your Committee has revised and reissued those Vereinbarungen, will those standards and methods then obtain official sanction—that is, will their authority be in any wise different from that which it was before?—Yes, to some extent. We have official Government laboratories at present in the different States; in Bavaria, for instance, in Saxony, in Prussia, and also in some of the smaller Governments. These official Government laboratories must use the methods which are prescribed, and when standards are fixed they are obliged to adopt them. At present we have not any butter standards; but I remember that, under the Sale of Wine Act last year, we have made standards for the extract and for the ash of wine. The official Government laboratories and the judges must adopt those standards; and, therefore, if we were to promulgate standards in the case of butter, the official Government laboratories in the Confederated States would be obliged to adopt them. But this superintendence of foods is undertaken, not at the instance of the Government nor at the instance of the municipalities, but practically at the instance of private persons; and, therefore, we cannot force people to adopt those standards.

10527. It appears, at all events, that your Government does, in effect, lay down regulations which determine what deficiency in any of the normal constituents of butter shall raise a presumption that the butter is adulterated?—In effect we do.

10528. Have you any information to give us as to the general character of butter in Germany and how it compares with the rest of the butter of Europe; that is to say, how far standards which may be based upon our experience in this country would be applicable to German produce?—We have had a great deal of experience on the question of the amount of water contained in butter, as we have analysed a great number of samples for water and also for ash. Many chemists in the different laboratories of Germany have been engaged on that work with the result that we have found that a standard of 16 per cent. of water is not too high nor too low. The question whether we should fix a standard for salt has not been quite cleared up yet, but I think in a short time we shall fix a standard for salt.

10529. You do not mean a standard, you mean a maximum limit of salt, do you not?—Yes, that is it. We have seen from the great number of samples we have had analysed that it would be possible in most cases to limit the sodium chloride to 3 per cent. The only question is whether the butter which is exported to South America or Australia, and which has to go a long way, might not perhaps require a little more salt. That point has not yet been cleared up, and I cannot say therefore now what we shall do.

10530. Have you made any suggestions as to the use of other preservatives, like boracic acid, or do you not take those things into consideration?—Other preservatives are not allowed, and the judges have given many decisions under the existing legislation prohibiting the use of other preservatives. Whilst we have been considering these questions of the standard for water, for sodium chloride, and for other preservatives in butter, we have also been considering what we should do in regard to the Reichert-Meissl figure. It is very difficult to say what the lowest Reichert-Meissl figure should be. I think in most cases genuine butter would not yield a lower figure than 24 or 25. A very well-known chemist at Münster, Dr. Böner (who is specially engaged in butter analysis) believes any butter which shows a lower Reichert-Meissl figure than 25 per cent. to be sophisticated. We know, however, in the case of Friesland butter and other butter, that it is possible to reach a lower figure. I must say that during the last five years I had to superintend the analysis of a large number of butter samples, and I never saw myself such a butter as Dr. Rijn speaks of, which gave the low Reichert-Meissl figure of 16 or 17.

10531. You have had no personal knowledge of such a butter?—No.

10532. Nor have I?—I think it would be an exception if a butter was proved to have such a low Reichert-Meissl figure. I think we must take care to get verified by other tests any lower Reichert-Meissl figure than 24. It is a very difficult question.

10533. The probability of your getting a butter with a Reichert-Meissl or a Reichert-Wollny number lower than 24, but which is a perfectly genuine butter, is very remote, is it not?—Only a few butters would be found which had a lower figure. The regulation to which I have referred deals with other points that I have not yet mentioned. For instance, it tells you how to determine the Koettstorfer number. The Koettstorfer number is not, I think, of very great significance. It also shows you how to take the Hehner number, and how to take the Hübl'sche number, the old figure used in the detection of lard. This document also describes the determination of those constituents which cannot be saponified, especially the determination of the phytosterin. We have only suggested that the melting point of the phytosterin should be taken, but I think when we come to revise this that we shall add some other determinations. I do not know whether you have seen or read the works of Dr. Bömer, of Munster, but recently he has taken a great number of the melting points of those constituents of different fats, including butter fats, which cannot be saponified. He has found not only the melting point of phytosterin, but also, which is of still greater value, the melting point of the acetic ether of phytosterin, which is very useful in detecting some adulterations of fat, especially of butter fat; and he has published his results. He has given a number of figures which he has found in samples of butter, which

Prof. Dr. von Buchka, Prof. Dr. P. Vieth, and Dr. H. Gerlich.

13 May 1902.

are, I think, very interesting. When we know that by the determination of the refractometer figure it is not always possible to recognise adulteration, and when we know that a few butters do give a very low Reichert-Meissl figure, I think it is very necessary to have another method which we can use which will detect nearly all the cases of adulteration which we may meet. We know that phytosterin is in most of the foods which are given to animals, but nevertheless phytosterin has never been found in animal fat—as far as we know only cholesterin is found in animal fat. Whether phytosterin is changed in the animal into cholesterin, or whether it is combusted, I do not know. We have at different times made the experiment of giving different animals phytosterin in vegetable oils—for example, sesame oil or cottonseed oil—in great quantity, and these experiments are still going on at the present time in the laboratories of the Board of Health. Although we have given these vegetable oils to pigs and calves, we have never found phytosterin, even when the quantity of vegetable fat taken has been very great. We therefore believe that in every case the phytosterin must be changed in some manner which we do not know yet. That is the basis on which Dr. Bömer has made his experiments. He says that the melting points of phytosterin and of cholesterin are different. Pure cholesterin melts at 145 degrees, and phytosterin at 136 degrees, and I think these melting points differ slightly according to the different substances containing the phytosterin and cholesterin. Dr. Bömer has said that the phytosterin in the vegetable fats melts at 136 degrees to 137 degrees, and that the cholesterin in the animal fats melts at 146 degrees to 147 degrees. Chemists, however, know that it is not possible to determine by the melting point the purity of a chemical compound, because small quantities of impurities may change the melting point very greatly. That is a well known fact. Dr. Bömer has tested a great number of ethers—of acetic acid, of propionic acid, and of other acids. He found that the acetic ether of phytosterin and the acetic ether of cholesterin differed in this respect: that the melting point of the acetic ether of phytosterin is higher than the melting point of the acetic ether of cholesterin. The pure alcohols of phytosterin and cholesterin differ from each other in this respect—that the cholesterin melts at the higher point, but with the ethers it is the phytosterin that melts at the higher point. If we have a pure chemical compound, and we dissolve it and crystallise it, we may expect that the melting point will not be much higher. Dr. Bömer separates the part which cannot be saponified—whether phytosterin or cholesterin, we do not know at first which it may be—then he heats it with anhydrous acetic acid to form acetic ether; then he dissolves the acetic ether of phytosterin or cholesterin in alcohol, and repeats that three or four times, and then sees at what point it melts. If he has a pure animal fat and pure cholesterin ether, then the melting point will at the third or fourth crystallisation be nearly 115. If he has pure phytosterin from a vegetable oil he will get at once to 123, 124, or 125 degrees. If he has been experimenting with a mixture of vegetable and animal fat, then he will get a mixture of phytosterin and cholesterin, and he finds that at the third or fourth crystallisation the mixture will melt at 116 or 117 degrees. He has experimented with samples of which he did not know the constitution, and he has at times had mixtures of animal fats and vegetable fats, which ultimately showed only 1 per cent. of vegetable fats. In those cases he got, at the fourth or fifth crystallisation from acetic ether a melting point of 116·05 degrees. When the quantity of vegetable fat was greater then the figure would be higher. He has sent me some tables which I will shortly explain, and then hand in. Dr. Bömer took a butter for which the Reichert-Meissl figure was 27·8. The highest figure for the melting point was 114·8. Then he took the crystallographic forms, but it showed no forms of pure cholesterin. Then he took some samples of oleo-margarine (animal fat) and added some cottonseed oil, and these tables show what results he got with those. The melting point of pure phytosterin he found was 133·1, and of cholesterin 145. Then he took some other samples which he treated with anhydrous acetic acid because he knew that the melting points of the pure alcohols were not sufficient without verification. Then he got some oleo-margarine from the manufacturer, of which he knew the composition. From the third crystallisation he found samples which melted no longer at 114 or 115 but at 127. In his experiments he also dealt with different samples of butter to which he added different quantities of sesame oil and margarine. First he took a butter to which he added 1 per cent. of sesame oil, and he found in the third crystallisation a melting point of 115 to 115·5, and at the sixth crystallisation he found the melting point went up to 117·3. With 2 per cent. of sesame oil in the third and fourth crystallisation, the melting point went up to 116·5 and 117·2. With 3 per cent. of sesame oil in the third crystallisation he got from 115·8 to 117·2. I need not go in detail through the other figures, but he added 10 and 20 per cent. of margarine, and in all cases where he had a mixture of vegetable and animal fats he found that by mixing the phytosterin and the cholesterin together, at the third crystallisation the melting point went up to 115·5, and at the fourth crystallisation to 117·5. He therefore thinks—and I think he is right—that when by means of the refractometer figure and the Reichert-Meissl figure we are not able to accurately determine the purity of the butter, we might go a step further and employ this method of testing for phytosterin and cholesterin. When these regulations for the analysis of fats are revised, this question I know will be regarded as one of very great importance, and I think that this method of Dr. Bömer will be among the first to be mentioned, as it will perhaps give us the possibility of recognising the presence of foreign fats. Having spoken of the value of his method, perhaps I should also point out the weak points of it. It is necessary if we adopt this process that we should use a great quantity of butter. We have here to deal with a very small portion of the constituents—only about 3 per cent.; and therefore we should take 100 grammes of butter, or, if that is not possible, at least 50 or 60. With any smaller quantity it would not be possible to carry out this test. (*The witness handed in Dr. Bömer's tables, and a description of his experiments.*)

10534. We have other methods of determining the presence of vegetable fats, for example, we have a very characteristic reaction for sesame oil which we can make use of without the recognition of the phytosterin?—We have some special directions for sesame oil, for cottonseed oil, and for arachis oil. It is known that the German Government requires the manufacturer of margarine to mix 10 per cent. of sesame oil with his margarine. That 10 per cent. of sesame oil can be recognised by the well known reaction with a furfurol alcoholic solution. If the margarine manufacturer really mixes sesame oil with his margarine, then it would be possible to recognise mixtures of margarine with butter. You must know that in Germany it is not prohibited to mix any other oil or butter-fat with margarine. The Sale of Butter Act states in one of the first articles that a certain quantity of butter-fat may be mixed with margarine. It is known that margarine manufacturers make an emulsion with a certain quantity of milk, but the quantity of fat which they get in this way from the milk must not be greater than 100 parts for every 100 parts of that fat which does not come from the milk. Therefore the law in Germany does not prohibit the addition of butter-fat to margarine, but it does prohibit the addition of butter to margarine, and if anyone added a small quantity of butter to a great quantity of margarine he would be prosecuted for it, as it would be regarded as an adulteration. In order to test for such an adulteration, the reaction I have just mentioned for recognising the presence of sesame oil is promulgated.

10535. That is the furfurol reaction?—Yes; that is what you will find in this print of the regulations. When these regulations were first published the phytosterin reaction of Dr. Bömer was not known. It is certain that it is now possible to recognise or to detect pure sesame oil, and also margarine, if the margarine has the prescribed content of sesame oil. But the detection of sesame oil has been sometimes difficult when the manufacturer of the margarine has introduced what are known as azo-colouring matters. When we use a solution of hydrochloric acid it is possible to get a reaction, which might be caused either by the sesame oil or by the azo-colouring matters by which the margarine has been coloured. We have, therefore, to pay regard to the fact that we may get this doubtful reaction with a solution in which we have hydrochloric acid.

10536. Sesame oil is not the only oil that is allowed to be used in margarine?—No; in the manufacture of margarine we can introduce all the vegetable and animal oils, only it is necessary always to include sesame oil.

10537. To the extent of 10 per cent.?—Yes.

Prof. Dr. von Buchka, Prof. Dr. P. Vieth, and Dr. H. Gerlich.

13 May 1902.

10538. The manufacturer may use cotton-seed oil, or arachis oil, or any other oil or fat, but he must at least use 10 per cent. of sesame oil?—Yes.

10539. Even in this case the phytosterin reaction would be necessary as a further confimatory evidence that it was margarine?—Yes. We have still some other methods indicated to us by the regulations which have been issued, where we think we have azo-colours. After taking these colours away we can employ the Soltsien'sche reaction. This is a test with chloride of tin which reduces the azo-colours and then enables us to obtain another reaction with sesame oil which can be very easily recognised. When we come to the revision of these regulations I am sure that point will also be regarded. There is still another direction in which I think Dr. Vieth has done some work. It is possible that if we give animals food which contains sesame oil cake, those animals may get with the other part of their food substances which we do not know yet, but which seem to give the Baudouin'sche reaction. Some chemists say that they have found that the substance I have just mentioned, sesame oil cake, goes into the fat of the milk and of the butter, and that if we make butter from the milk of those cows which are fed with sesame oil cake, then we get a butter in which there is naturally sesame oil and which gives the Baudouin'sche reaction. By the introduction of sesame oil into the milk in this way it would, of course, be quite possible for a manufacturer of butter to be suspected of mixing margarine with his butter, when, in point of fact, he is guiltless of doing any such thing. I may say, however, that we are not quite sure about the results of the experiments which have been made in this direction. I know that at the present time these experiments are being repeated in the laboratories of the Board of Health at Berlin, and that they have been made in the laboratories of some agricultural stations at Halle and at Kiel. I think the results of the experiments now going on will be very interesting. It is necessary that these experiments should be continued, because sesame oil cakes are being used in very great quantities as food for animals. If it is possible that the sesame oil in these cakes should go into the milk fat, then naturally it would be possible that the butter made of this milk should show a Baudouin'sche reaction. But then I think that in that case we ought also to come upon the phytosterin, for, according to the experiments which were made at the time when I was in the Board of Health, phytosterin ever appears in margarine fat.

10540. Perhaps Dr. Vieth will tell the Committee about his work upon the recognition of the substances which give the sesame oil reaction?—(*Dr. Vieth.*) We were asked by the Prussian Government to make some experiments on feeding cows with sesame cake. We got the milk of those cows and turned it into butter and made these reactions. There were certainly a good number of samples which gave not very distinct reactions, but still which did give Baudouin'sche reactions, which seems to show that to some extent the active body in sesame oil passes over into the animal. We sent all the samples we had remaining to the Board of Health, who analysed them and found the same indistinct reactions. It was really not a question of the possibility of 10 per cent., or even 5 per cent. of margarine being suspected to be present, but still there were these small reactions; and that was conclusive to me that these reactions were not to be laid too much stress upon. We should be very careful, if it is only a slight reaction, in saying that we are dealing with a sophisticated butter. Of course, the whole object of putting sesame oil into margarine was to decide the question, and if there is any reaction with sesame oil which makes it difficult to distinguish between pure butter and adulterated butter, that seems to raise a doubt about the wisdom of putting sesame oil into margarine.

10541. With all submission, I do not see that these minute traces of sesame oil which could be discovered in these conditions would raise any difficulty in the mind of an analyst?—(*Dr. von Buchka.*) It is naturally of the greatest importance for the German Government to prove this question, for if it was shown that the sesame oil reaction could be generally found in the pure butter of cows fed on sesame oil cake or sesame oil, then it would not be advisable to continue the regulation that 10 per cent. of sesame oil should be added to margarine. What Professor Thorpe has just said is very interesting, and it is the fact that up to the present time we are not yet convinced that there is any very great danger in this direction; and that is the reason why the German Government has not yet changed the regulation. I might state that at the beginning of this year the Austrian and Belgian Governments decided that margarine should contain sesame oil, a little starch having to be added in Belgium.

10542. (*Mr. Gibbons.*) With all the valuable knowledge, very extensive as it must be, that your German chemists have as to adulteration, do you think it would be possible for you to be certain in the case of butters which contained only 2½ per cent. or 5 per cent. of foreign fats?—I think that would be difficult. The experiments of Dr. Bömer, I think, show that it would be possible to recognise 1 per cent., but we must bear in mind that a great deal of skill on the part of the chemist is necessary in order to do that. As I have said already, in order to get the reaction it is necessary to take nearly 100 grammes of butter, because if we have a smaller quantity the reaction would be much more difficult to obtain. I think, therefore, it would be very difficult to recognise these small additions of vegetable fats.

10543. Would it be difficult to recognise 5 per cent. or 10 per cent.?—10 per cent. could be detected in all cases.

10544. You could be sure of 10 per cent.?—Yes, and of 5 per cent. also, I think.

10545. Do prosecutions often take place in your country?—Yes; in cases where it is proved that adulterations do take place, the manufacturers are prosecuted.

10546. Do they take place mostly for added fats or for undue proportions of water?—I have reports here from the chemical laboratories at Hamburg and Breslau and other cities, and last year I find there were not many prosecutions for adulterations by margarine, but there were a great many prosecutions for excess of water in butter. But those things are different in different places. I know that in Berlin, for instance, prosecutions for the adulteration of butter with margarine were at times very often instituted, and very seldom at other times. Usually I think the question of water is the question of most importance, and that is now dealt with by the law that butters shall only contain 16 or 18 per cent. of water. Until that law was promulgated the judges did not know what they should take for the maximum figure; and so on the one hand butter manufacturers have been prosecuted successfully if their butter only contained 16 or 18 per cent. of water, and on the other, the prosecution has failed even when the butter was proved to contain 20 or 24 per cent. of water.

10547. Are the butters exported from your country subjected to any examination, and is any brand put on them in any shape or form?—The merchants who export butter from Hamburg have joined together and submitted themselves to an examination of their butter. I think Dr. Vieth knows more about that.

10548. Would that be done by the Government, or simply by the action of the merchants themselves?—It was done by the merchants privately.

10549. Have you a large and increasing trade in the exportation of butter from Germany?—(*Dr. Gerlich.*) No, on the contrary. (*Dr. Vieth.*) It is decreasing.

10550. (*Professor Thorpe.*) Dr. Gerlich was instrumental in bringing about that control in Hamburg, I think?—(*Dr. Gerlich.*) I was only instrumental.

10551. (*Mr. Gibbons.*) Is it optional whether that examination takes place?—It was done in order to raise the reputation of the butter, which was rather in disrepute then. The Senate of Hamburg insisted upon making a reform, and then the exporters themselves met the Senate by offering that the butters should be examined.

10552. (*Chairman.*) Are there any analytical experiments in progress in Germany now which would be likely to affect the decision which this Committee might come to within its reference? As you are aware, we are going to try and fix some standards for the direction of our courts of law?—(*Dr. von Buchka.*) I do not know what are your intentions. Have you the intention to fix the Reichert-Meissl figure, or have you the intention to fix a smaller figure for water than 16 per cent.?

10553. The percentage of the water is settled: we have now to deal with the other adulterants, the other extraneous matters?—It would be for the German Government to say whether a Reichert-Meissl figure could be fixed; but, as I said before, it is always difficult to fix such numbers, if one does not give at the same time directions as to the manner in which the butter could be tested in those cases where a smaller Reichert-Meissl figure was found. In other directions I think we have no experiments at present going on.

Prof. Dr. von Buchka, Prof. Dr. P. Vieth, and Dr. H. Gerlich.

13 May 1902.

TWENTIETH DAY.

MEETING HELD AT BURLINGTON HOUSE, PICCADILLY, W.

Wednesday, 14*th May*, 1902.

PRESENT:

The Right Hon. HORACE CURZON PLUNKETT (*Chairman*).

Sir CHARLES A. CAMERON, C.B., M.D.
Professor T. E. THORPE, C.B., LL.D., F.R.S.
Major P. G. CRAIGIE.
Mr. CHRISTOPHER DUNN, J.P.
Mr. GEORGE GIBBONS.
Mr. JOHN GILCHRIST.
Mr. PATRICK HICKEY.
Professor J. M. THOMSON, LL.D., F.R.S.

Mr. A. E. BALLEINE, *Secretary*.

Mr. GEORGE LEWIN, F.I.C., recalled; and further Examined.

Mr. G. Lewin.

14 May 1902.

10554. (*Chairman.*) You have already given evidence before us upon the question of the amount of water in butter, and I understand that now you are prepared to give evidence upon the other portion of the reference to us upon which you have arrived at certain conclusions?—Yes, I am now prepared to give evidence as regards the chemical constitution of butter.

10555. (*Professor Thorpe.*) In the *précis* that you have submitted to the Committee you have made some observations upon the various tests, chemical and physical, which are open to the analyst on which to make an inference as to the genuineness of any sample of butter. Perhaps it might be desirable to have your opinion as to the relative value and applicability of those several tests. In the first place, with respect to what is called the refraction number, what is your experience as to the applicability of the refractive index, either directly or indirectly obtained, on butter?—It is a very useful test when you find that the refraction is low and within certain limits—that is between 37·5 and 40.

10556. That is with the Zeiss instrument?—Yes, and reading at 45 degrees Centigrade. You have in that a very strong confirmation that the butter contains those characteristic acids in such quantity as to bring it within the range of what is regarded, without dispute, as genuine butter.

10557. At the same time, the limits which genuine butter may have as regards its refraction number are so wide that it is quite possible that a considerable addition of margarine might be present without detection?—Yes, a very considerable proportion might be added. If you take a butter with 38·5 divisions, and add 25 per cent. of margarine, the refraction will still only be 40·7. But a very large proportion of genuine butter stands at 40·7 or thereabouts, and even higher, so that you have no criterion at all as to the presence of margarine from the fact that it has a refraction of 40·7. The value of the refraction number is that if you get 38·5, you have then presumptive evidence of genuineness of nearly an absolute kind.

10558. Then, as I understand it, the general inference you draw is that the Zeiss instrument is only of comparatively limited application?—That is really how the matter stands.

10559. And that substantially it is an instrument which can only be useful as a corroborative test?—Yes; and when you have a large number of samples it is very useful in weeding out those that are doubtful. In a word it is a test corroborative of genuineness, when the refraction is low—that is, between 38 and 40 divisions—but it neither supports an allegation of adulteration, nor disproves it when the refraction is between 40 and 43.

10560. Now, with regard to what is known as the iodine number. We have already had the definition of the iodine number given to us by former witnesses, and therefore I need not trouble you to explain to the Committee exactly what is meant by the iodine number. What have you to tell us as to the applicability of the iodine number as a valid criterion of genuineness?—It is really of no value at all. The results which are obtained from this test, rather go to obscure the issue than otherwise; because you have this iodine number rising and falling in a direction contrary to that test upon which we are most agreed to rely. As I have experienced in my own evidence before the Courts, it becomes a rather useful weapon in the hands of the defence, which might claim that the iodine number of an impugned sample being within the range, was so far an evidence of genuineness, a statement which might very likely obtain credence on the part of the bench, in fact, I know it has done, whilst, as a matter of fact, it neither supports the allegation of adulteration nor disproves it.

10561. In other words, the introduction of the iodine number rather clouds the issue?—Quite so.

10562. Now, the next criterion to which you make reference is the specific gravity of the butter fat; what have you to say respecting that factor?—Next to the estimation of the volatile acids of the butter fats, and the correlative tests for soluble and insoluble acids, the specific gravity is the most useful and accurate criterion of the composition of butter fat, a high gravity being nearly always associated, I might say always associated, with a high percentage of volatile acids, and a low gravity giving low Reichert-Wollny figures. It is an important adjunct to the other tests, and is probably, in a good many cases, more accurately indicative of the genuineness of a butter than the volatile acid number itself. The volatile part of the butter acids does not comprise all the characteristic acids of butter, neither is there much known as to the proportion of these intermediate acids in butter fat; and it may therefore reasonably be inferred in the case of butter fat with moderately low percentages of volatile acids, associated with an average specific gravity, that the latter more accurately defines the quality or character of the butter fat, as it takes account of all the constituents of the fat. That is to say those intermediate acids give weight in the gravity, whilst they are not shown in the amount of volatile acids actually recovered over by the process of distillation.

10563. Then, the general impression that you wish to convey to the Committee is that, in your opinion, the specific gravity of the butter fat is a very important and significant criterion?—Yes.

10564. Now, as regards the soluble and insoluble acids; what have you to tell us as to the value of the determination of those acids?—The estimation of these two descriptions of acids is attended with some difficulties, the process being much more lengthened and intricate than in the case of the estimation of the volatile acids, and one in which the personal equation

Mr. G. Lewin.

14 May 1902.

comes in to a very much larger extent than in the other tests. It is not so likely to yield concordant results in the hands of different analysts as in the case of the distillation method. It is a valuable corroborative test, and in doubtful cases it is always advisable to apply it.

10565. By the personal equation do you mean the relative expertness of the analyst?—Yes, and also the extent to which some of the processes are carried, such as the washing-out process. One analyst might feel justified at stopping at half a litre, whilst another might take three-quarters, and another a full litre.

10566. But, if necessary, that difficulty could be got over by actually determining both the temperature and the amount?—I am rather speaking now of the history of the case in the past. I know that could be defined; but even then there is a large personal element in the application of this test.

10567. Now, we come to what is known as the Reichert-Wollny number, or sometimes the Reichert-Meissl number; but we will call it the Reichert-Wollny number, that term signifying that we take five grammes of fat. What have you to tell us with respect to your experience of the determination of the volatile acids by the Reichert-Wollny number?—The determination of these acids by what is known as the Reichert-Wollny method is likely to yield concordant results in the hands of different analysts, inasmuch as the experimental conditions are rigidly defined, and little is left to personal equation. This is a great desideratum in any test generally adopted, or which might be recommended as one to be employed in fixing a standard or governing limit for butter. It only remains to find that genuine butters give nearly similar proportions of volatile acids, to raise this test to one of high eminence. Unfortunately, this is not the case. In the face of this, however, we have to enquire, supposing the Reichert-Wollny number were taken as a criterion of genuineness, how far the results stated in the tabular statement I have to bring before you, allow of the adoption of a figure sufficiently high to prevent serious adulteration, and yet such as would not be likely to involve hardship on innocent persons in raising a presumption that the butter was not genuine.

10568. During the last year the Government Laboratory has made, by direction of the Board of Agriculture, a considerable number of analyses of the butter which is yielded in all parts of Great Britain and Ireland, has it not?—Yes; and I have prepared a table showing the results. (*Appendix XXX., p. 577.*)

10569. Would you kindly give the Committee a sketch of the system adopted in obtaining those butters, and show how far they are representative of the produce of Great Britain and Ireland? Can you tell the Committee precisely the method by which those butters were selected in the first instance by the officers of the Board of Agriculture?—I am not sure that I can tell you what was the nature of the communication sent to the farmers; I do not think that I had information of that. I know that the Board of Agriculture did communicate with farms, creameries, and dairies which were intended to cover different parts of Great Britain and Ireland, both Lowland and Highland, so that we might, by the analysis of the butters obtained from those places, get fairly representative samples, such as would be yielded by all kinds of cows, and from different latitudes, if I might put it so; that is, from the north of Scotland, from different parts of Ireland, and also from the north of England, together with the lowlands of England, in the hope that we should cover every condition to which the cows might be subjected through the year.

10570. Those conditions being, of course, exposure to such climatic influences as cows are likely to be subjected to in this country, either stringent climatic conditions or mild climatic conditions?—Yes.

10571. Also, I believe, they were so arranged as to cover different periods of lactation of the cow, different kinds of breed; in fact, so far as we could forecast, all the elements which are likely to enter into or to determine the character of butter?—Quite so.

10572. So far as you know, that was arranged by the Board of Agriculture?—Yes.

10573. (*Major Craigie.*) Are you also aware that very special care was taken, as regards the Scottish samples, to obtain from districts with which we were not particularly acquainted, namely, from the north and west of the Highlands, a rather special number of samples, those being the districts where the conditions were particularly rigorous as regards the animals used for milking?—Yes.

10574. And further, that a good deal of correspondence took place with a view of getting really representative districts of the north-western Highland regions and the islands of the north?—Yes, so as to throw light upon the effect of climate and conditions of food.

10575. I would like to put this question, because I think it is desirable that we should get the Committee to understand what the large proportion of samples from the north and north-west of Scotland means: It is not a geographical proportion, but it is more than a geographical proportion in the poor Highland districts?—Yes.

10576. (*Professor Thorpe.*) Now, would you kindly tell the Committee in general terms what are the results of this investigation. In the first place, how many farms does it comprise?—Samples are taken from 40 different places, mostly farms, but a few creameries.

10577. How many of them are in Scotland?—14.

10578. How are they distributed in Scotland?—We have one near Glasgow; one in Aberdeenshire, at Alford, a Highland neighbourhood; one at Kilmarnock, which is in the Lowlands of West Scotland; one at Cogle Watten, in Caithness, which is a county I happen to know, in an extremely exposed part, where the wind blows with great severity during parts of the year. Then one from Shinness, in Sutherland, which is a purely Highland district; one from Latheron Wheel, on the coast of Caithness; one from Sanday Farm, in the Orkney Islands; one from Brora, Sutherland, which is in the Highlands again; one from Rogart, Ross-shire, which has rich pastoral land in the valleys; one from Strathcroy, Sutherland, a Highland district; then in the west country we have one each from Gerinish and Dremisdale, in South Uist; and finally, one from Sumburgh Farm, in Shetland.

10679. Were the farms in South Uist and in Sumburgh farms where it might be presupposed the cattle would be exposed to rigorous climatic conditions?—Yes; that was the idea.

10580. They would experience there frequent damp, and in some cases not very good pasture?—Yes.

10581. Now let us come to the English representative samples; how many localities were they taken from in England?—14.

10582. How are they generally distributed in England?—They are pretty widely distributed. We have the east coast of England represented by Wye, the Ipswich Dairy; Whittinghame, Norwich, and the Colonial College, Suffolk. The east, therefore, is fairly well represented. Then the rich pasture land is represented by Wrotham Park, Barnet, and Buscot Park Dairy, Sharcombe, Wells, in Somerset, and Bickenhall Farm, near Taunton. Then we have something in the nature of the west of Scotland in the farm at Lledwigan, Llangefni, Anglesey. It is very flat and exposed to a good deal of severe climatic conditions.

10583. (*Mr. Gibbons.*) Bickenhall Farm is on some of the poorest land in Somerset, and I would not give 10s. an acre for it?—It is capable of yielding extraordinarily good chemical figures.

10584. By the cattle being very highly fed generally, but it is really poor land?—I was not aware of that.

10585. (*Professor Thorpe.*) Does that comprise all you have to say with respect to the English samples?—No, not quite. We had samples from one farm in the north of England—Newton Rigg, Penrith. We had only one or two samples from Cumberland, but they are of the same nature. Then we had samples from two or three dairy schools. I have drawn attention to the very anomalous figures obtained from these, and I can only assign them to some extraordinary treatment on the part of the managers of the dairies. I think the cows are not normally treated. There appears to be no other explanation why these dairy schools should give such anomalous figures.

10586. You mean that the cows are being placed under experimental conditions?—Yes.

10587. And that they are not very happy?—Whether the effect is physical or mental I am not quite sure but it would be really well for those dairies to know what the results are, so that, if possible, they might look into it.

Mr. G. Lewis.

14 May 1902.

10588. (*Major Craigie.*) Does that apply to the Scotch dairy schools as well as to the English ones?—No, it only applies to these two dairy schools.

10589. (*Mr. Gibbons.*) May we ask what they were?—The East and West Ridings County Council Farm at Garforth, near Leeds, is the one which gives butter of such low figures that it is almost impossible that any cow could yield it if she were at all properly treated.

(*Major Craigie.*) That is a very new school, is it not?—I do not know anything about the history of it.

10590. (*Professor Thorpe.*) That is a school in connection with the Yorkshire College. Have you seen a paper by Mr. Herbert Ingle upon the nature of the milk produced by the cows of that college?—No, unfortunately I have not.

10591. He has published a paper in which he says that the dairy in connection with that school is characterised by yielding milk containing what I may call an abnormally low proportion of fat. He has published that paper with the view of showing that the standards adopted by the President of the Board of Agriculture in connection with milk are too rigorous. He shows that on a considerable number of occasions the cows do not yield anything like 3 per cent. of fat. Have you anything more to say about the English farms?—I have exhausted all the English localities.

10592. Now let us hear about the Irish farms?—We have 12 stations sending samples from Ireland; unfortunately they did not send in so early as the Scotch and English samples were sent in, so that there are not so many Irish samples for the purpose of comparison.

10593. How are they distributed?—They are distributed almost more fully over Ireland than the others are over England. We have had samples from Antrim, Enniskillen, Armagh, Donegal, Cork, Dublin, Limerick, Kerry, Tipperary, and Kilkenny, so that these samples really cover a very large proportion of the Irish dairy districts.

10594. (*Chairman.*) The samples came mostly, I think, not from individual farms, but from co-operative creameries?—Yes, and therefore require to be judged from a somewhat different standard, because, though a large number of cows are shown as yielding the butter produced at each creamery, it would only be from a fraction of the cows on any one occasion that our sample of butter would be obtained.

10595. (*Professor Thorpe.*) In other words, I suppose the inference from that would be that those samples represent more accurately what would be the average composition of butter in Ireland than would be the case in England and Scotland?—Yes, I think so.

10596. In the case of England and Scotland the samples were obtained from individual farms?—Yes.

10597. Whereas in Ireland they were mainly obtained from co-operative creameries?—Quite so.

10598. That is to say, places which would have the produce of a considerable number of farms?—Places which would have a large constituency, amounting in some instances, I think, to from 1,500 to 2,000 cows. Of course I do not mean that I got a sample of butter from all those cows, but it would be some portion of that constituency yielding the butter.

10599. (*Major Craigie.*) May we take it that these are samples of mixed herds in Ireland and of single herds elsewhere?—Yes.

10600. (*Mr. Hickey.*) Would that probably explain the fact that the Irish samples do not reach the same high level in volatile fatty acids as is the case with the Scotch and the English samples?—Yes, I think they are averaged down owing to that circumstance. At the same time I think that Ireland naturally yields butter with figures on the whole a little lower than the average of either Scotland or England.

10601. (*Professor Thorpe.*) How frequently were the samples sent to you?—We received them every month in nearly all cases. One dairy sent us duplicate samples each month, but that was the exception; otherwise we had samples nearly every month until they ceased sending, which happened where they told us the cows had gone off, and they could not give us any more.

10602. What particulars accompanied those samples?—I have here the full record of both the analyses and the particulars, which I can give you if necessary. Take, for instance, the United Creameries at Dunragit, which is an exceptional instance of butter coming from a creamery in Scotland. They give us the number and the breed of the cows there. Dunragit farm, or creamery, had 400 Ayrshires up to September—all up to this time on grass, and the lactation period was from six months to one month. They seem to have been the same cows for the first three months, and then they put on 400 more Ayrshires, and we got samples for the next three months from this larger amount; but the lactation period appears to have been about the same in both those cases.

10603. Did those particulars as to breed, feeding, period of lactation, etc., accompany the samples in all cases?—In all cases excepting from Ireland, where, from the nature of the source of supply, I suppose it was impossible to get those particulars.

10604. (*Major Craigie.*) The feeding could not possibly be given where the cows were on different farms?—No, and in Ireland they did not attempt to give the feeding. The people sending samples are very particular in noting when the cows are out of doors, when partly out of doors, and also when they are entirely indoors. These are very important particulars, because from these you find that when changes in the analytical figures take place the explanation may be found in this fact, whether they are indoors or partly out of doors. It is very important to notice that it is at that period of the year when they put them in and out, when it is so trying for the cows, that the power of producing normal butter seems to be affected.

10605. (*Chairman.*) Would you look at Nos. 34 and 35, and note the figures for the samples taken in December from the Munster Dairy School at Cork and the Albert farm at Glasnevin. Could you tell us the particulars relating to the former sample, which comes out at 20·6, and the latter, which comes out at 35·1?—In the case of No. 34, which came from the Munster Dairy School, the cows which produced the butter are given as 17 Shorthorn cross, and they were out of doors at the time—December—that is the explanation. I should think the lactation period was from March to May, not at all a severe period, or at least, not one to which you would assign low figures from May to December. That is the case where we have the Reichert-Wollny number of 20·6.

10606. (*Professor Thorpe.*) Were the cows stalled in the following January, when the number ran up to 28·4?—Yes, they were indoors then—turnips, mangolds, and grains were given, and immediately the figure ran up to 28·4.

10607. That is a case on all fours with what we have been given to understand occurs in Friesland. You put down the 20·6 to the fact that the cows were out of doors and exposed to the wet and the cold?—Yes, in December.

10608. And when they were put into the byre and kept warm then the number ran up to 28·4?—Yes, and in March and April the figures were 28·7 and 27·9. This is a very striking illustration of what I incline to hold now pretty strongly, namely, that the effect of the period of lactation is an absolutely insignificant factor.

10609. (*Sir Charles Cameron.*) In determining what?—In determining the proportion of volatile acids which may be found in butters.

10610. (*Major Craigie.*) Do you mean that the figure is not lowered at a greater distance from the time of calving?—It is not lower at a greater distance from the time of calving than it is in the middle of the period of lactation. The whole thing, I think, is explained by bringing about a condition of comfort, climatically, and also no doubt in food as well. That is an almost universal result.

10611. (*Professor Thorpe.*) Now turn to the Albert farm at Glasnevin, No. 35; what were the conditions prevailing there during those months?—In November the cows at Glasnevin were four Shorthorns, cross; and they were indoors on November 16th.

10612. Were they indoors in December?—They were indoors all along, and they were fed on hay, mangolds, decorticated cotton-cake, grains, and bran. The cows were of the same breed, and the effect was to yield figures which are, for Ireland, quite phenomenal. The highest Reichert-Wollny figure yielded at Glasnevin was 35·1—the lowest being 30·3 during May, December, January, February, March, and April.

10613. There is only one other low figure also in December at Ardagh—what are the particulars connected with that which have been furnished to us?—Unfortunately we have no particulars; this is one of

Mr. G. Lewin.

14 May 1902.

the cases in which the constituency of the creamery embraces 2,100 cows.

10614. Ardagh is a creamery, then?—Yes.

10615. Of course we have no record of whether those cows would be mostly out or in?—No, but the inference is almost certain that they were out.

10616. What was done in the Government Laboratory with the samples we received; what analytical procedure was adopted?—The sample when received was first examined microscopically to ascertain whether there was any appearance of crystalline fat. When that was done the sample was brought into the state of a soft emulsion and shaken up, so that the water would be equally distributed. From that a portion was taken for the estimation of the water. That is, we followed what we believed to be the most accurate method of testing for water by making a thorough emulsion of the butter first.

10617. That is the method, in other words, which was brought to the knowledge of the Committee by Mr. Faber as being in use in the Danish dairies?—Yes, substantially that is what was done.

10618. Although we are not concerned immediately with the water question now, perhaps the Committee would like to know what the results, as regards water, were from the samples collected in the United Kingdom. You might briefly go down your table in order to show roughly the kind of numbers which we get?—Take the South-Eastern Agricultural College at Wye, the water in their butters ran from 12·8 to 14·9 per cent. in one series, and in a second series from 11·2 to 13·8. In the Eastern Counties Dairy Institute we found from 10·9 to a maximum of 13·0. In the case of Mr. Taylor's farm at Whittinghame (near Norwich), which appears to be a very well-conducted dairy, 10·9 was the minimum and 14·3 the maximum. In the case of Wrotham Park Farm the figures ranged from 11·1 to 12·7. At Newton Rigg, Penrith, we had 11·1 to 13·0.

10619. Perhaps those will suffice for the English figures; now let us know the Scotch, and then we will go to the Irish creameries?—Take first the United Creamery at Dunragit; that shows a somewhat higher percentage of water than the figures I have just read out. Their figures run from 12·3 to 15·7, there being three 15's.

10620. Take the example of a hillside farm, or a small farm, such as you get in South district or in the extreme North of Scotland?—The butter from Cogle Watten showed a minimum of 9·3 and a maximum of 12·8.

10621. (*Mr. Gilchrist.*) Can you give us the figures for the Newton Farm?—The minimum there was 14·4 and the maximum 18.4. I am not sure but that in some one or two instances they left some water in the bottle; that is to say, we could not be quite sure whether it drained from the butter or whether it had been put in carelessly or not.

10622. (*Professor Thorpe.*) We must assume, however, that the bottles were dry?—Yes.

10623. (*Mr. Hickey.*) Was it loose water?—Yes, there was a quantity of loose water which became mixed up afterwards.

10624. (*Professor Thorpe.*) What was the maximum number in any sample of Scotch butter?—Wester Fowlis, in Aberdeenshire, appears to me to have been the highest—that was 19·0.

10625. (*Mr. Hickey.*) What was the lowest at Wester Fowlis?—12·7. That 19·0 was quite exceptional.

10626. (*Professor Thorpe.*) At what period of the year did you get that sample giving 19·0 of water?—That was on November 29th.

10627. It was not at a hot time of the year, then?—No, it was not. The other six samples from Wester Fowlis run from 12·7 to 14·9.

10628. Therefore that 19·0 was quite exceptional?—Yes, and we got that figure from that farm alone.

10629. Now please summarise the results as regards water obtained from the Irish creamery butter?—In the samples from Rossmore we found a minimum of 12·3, the highest being 16·0; the Piltown creamery showed a minimum of 13·9 and a maximum of 15·0, the Ardagh ranged from 14·0 to 15·9; Abbeydorney from 13·2 to 14·2, and Mourne Abbey from 13·2 to 16·9—that appears to me to be the only instance showing more than 16 per cent. of water.

10630. That I think will do for the Irish. How many samples of butter have we analysed altogether, do you remember?—311.

10631. How many times did the amount of water exceed 16 per cent.?—I think I have read all the ones above 16, namely, five.

10632. Out of the 311 samples there were at least five occasions upon which the amount of water exceeded 16 per cent.?—Yes.

10633. (*Major Craigie.*) Of the highest, two were Scotch?—Yes, Newton Farm and Wester Fowlis.

10634. Were the other three Irish or English?—Two were English and one Irish.

10635. (*Professor Thorpe.*) So much for the water; what other analytical determinations were made?—We estimated the curd and also the salt, and by difference the percentage of butter fat.

10636. Between what figures would the salt range?—The salt ranges up to 3·5 from nothing. As a rule the salt does not go above one and a fraction in nearly all the butters.

10637. What is the average amount of curd; is that fairly uniform, or is it very variable?—The curd is not very variable, it is rather low. It appears to me as if they were able to cope with this question of curd now by reducing the amount almost to a minimum. I see that is the case of the Irish samples as well, the amount being under 1 per cent. in a great many cases, and seldom or not at all rising to 2 per cent.

10638. What would be the average percentage amount of butter fat?—The average percentage is about 84; that is to say, allowing an average of 13 per cent. for water, and allowing 3 per cent. for the salt and the curd, 84 would be about the average for the butter fat.

10639. Does that exhaust all you have to say with respect to the proximate constituents of the butter?—Yes.

10640. Now we come to the character of the butter fat. First of all, what have you to tell us about the variations in the Reichert-Wollny numbers of the butter fat?—Having regard to the results obtained in the recent inquiry into the composition of butter obtained from various parts of the United Kingdom, it may be observed that of those from English farms no sample would be impugned on a limit of 24·0 Reichert-Wollny. But this is not the case if you include two farms connected with dairy institutes in which the results are so phenomenal as to lead to the conclusion that the experimental course carried out at these institutes has seriously affected the capacity of the herd to produce normal butter fat. I think that these figures need not be taken into consideration in fixing a limit. In contrast to these are the results obtained from butters from Wrotham Park, Barnet, in which the volatile acids are nearly on an exact level from May to February. I think that this is very important, because if you could once establish in the case of any one farm that there is no decline throughout the year, that is quite good enough to show that the lactation period is an insignificant factor. It might be very important to our general dairy interests to know how this remarkable result has been brought about. The Colonial College, Suffolk, shows nearly the same uniform level. These results seem to show that a little attention to the principles of the best dairy practice would eliminate very shortly all butters giving low or exceptional figures.

10641. Now what have you to tell us as regards Scotland?—Coming to the samples from Scotland, the first point to observe, and one not quite in line with the view commonly accepted, is that the proportion of volatile acids is generally higher than in English samples, and in other words, that high latitudes are not unfavourable to high percentages of volatile acids in butter, at least in this country. Applying a limit of 24 Reichert-Wollny to the Scotch butters, three of the numbers would raise a presumption of admixture with foreign fat to the extent of 4 per cent. One of these is from an exposed part of the country in Caithness in November, and two from a farm in the neighbourhood of Glasgow, where the cows can scarcely be regarded as under the conditions most favourable to the production of butter with average Reichert-Wollny figures.

10642. Why do you say that in connection with the Glasgow samples?—I think that is due to their mixed feeding.

Mr. G. Lewis.

14 May 1902.

10643. (*Mr. Gilchrist.*) Are you referring just now to Newton Farm?—Yes. The cows there were five Ayrshires, and the period of lactation in June was from two to three months. The same cows continued right away up to December.

10644. (*Professor Thorpe.*) What are the particulars as regards the feeding of those cows?—They were fed on sewage grass; I do not know whether that would influence the results.

10645. (*Mr. Gilchrist.*) That is Italian rye grass which water has been running over—grass that has been partly irrigated?—Yes; they also had hay and cabbages given to them.

10646. (*Mr. Hickey.*) Is there much butter made about Glasgow?—I could not tell you.

10647. (*Sir Charles Cameron.*) Do you think that treatment is more important than difference in the breed or in the feeding?—I take it that living near a town the feeding would be of a somewhat nondescript character.

10648. What do you say about the breed?—I do not know that there is anything in the breed.

10649. (*Major Craigie.*) Have you seen Mr. Speir's descriptions of his own experiments on this subject, which have been published very largely, and were brought before the Milk Standards Committee?—Yes, I have seen them, but I have not refreshed my memory as to them.

10650. You have not referred to them on this point?—No, I have not.

10651. (*Professor Thorpe.*) Now with regard to the Irish samples?—The Irish samples are fewer in number than those obtained from England and Scotland. The amount of volatile acids seldom reaches high figures, being more of an average quality than those of the other two countries, excepting those from Glasnevin, where the figures are abnormally high. A limit of 24 Reichert-Wollny would affect three of the samples indicating the presence of from 3 to 10 per cent. of other fat. Two of the samples having the lower Reichert-Wollny figures are December butters, and as it is almost phenomenal to meet with butters produced in December with such low figures, I cannot but think that they were produced under exceptional conditions, which might easily be found out and corrected.

10652. (*Mr. Hickey.*) But you have no knowledge that they were produced under exceptional conditions, have you?—Yes. They were out of doors in December, and immediately they were brought indoors up went the figure to 28.

10653. (*Chairman.*) Do you mean that those samples actually indicated the presence of 3 to 10 per cent. of foreign fat?—No.

10654. (*Professor Thorpe.*) You really mean that the Reichert-Wollny figure might be consistent with 3 to 10 per cent. of foreign fat being there?—Yes, I only mean that. That is a mere matter of phrasing.

10655. Of course there is no deception whatever in those particular cases?—No, nothing of the kind.

10656. What is your general deduction from the whole of these analyses?—That the number of samples giving less than 24 Reichert-Wollny is very small, not more than 3 per cent., if we exclude the results from two county council experimental farms. These results are in practical agreement with those obtained from the earlier investigation into the composition of butter carried out on the passing of the Food and Drugs Act of 1875, under which we dealt with samples referred to us by the magistrates. Although the analytical data did not then include the Reichert-Wollny number, yet we are able to interpret the earlier results in the light of more recent work, with the result that in only three instances out of 113 did the results indicate an abnormal butter.

10657. Are you of opinion that a Reichert-Wollny number under 24 indicates that the cows were under exceptionally uncomfortable conditions?—Yes, I am strongly of that opinion. I think it may be proved from the Danish experiments as well as those carried out in Norway, that the cows at the time were undergoing physical suffering or discomfort, either from undue exposure to cold, excessive heat, or improper feeding, so as to constitute in the herd a temporary unhealthy condition, preventing the animals yielding butter fat of normal composition. I am, therefore, of opinion that the product of cows undergoing physical suffering ought not to enter into the question in considering what limit might be adopted for volatile acids.

10658. Do you recommend to this Committee that a limit of 24 Reichert-Wollny would be a limit which they might set up?—Yes, I strongly recommend it for various reasons, and all the more so because since this inquiry has been started evidence has been given before you that some analysts would go as low as 20 before they would impugn a sample. That fact had never become public before, and it is a very serious and grave fact, I think, for your Committee to consider. Those disposed to adulterate will not mind stopping at 24, where they might have stopped before, because it has always been held that 24 or 25 has been the limit on which analysts have worked hitherto; but if now it is known that any body of opinion in this country would be in favour of not impugning a sample showing a Reichert-Wollny number of 20, then there will be nothing to prevent the adulterator going down to 20 with his admixture, which would be an extremely serious state of things. To check that, in my view, you ought to safeguard the position by recommending a Reichert-Wollny number of 24. I do not see why that should not be done.

10659. In other words, what you wish the Committee to understand as your deduction is that the limit at which a presumption might be raised that the butter was not genuine might be fairly fixed at 24?—Yes, and although any cows giving butter showing a Reichert-Wollny figure of 22 or 20 might be able to escape conviction, that would be no justification for your accepting so low a statutory limit. If you were to go as low as 20 there would be no need of a limit at all, because all analysts would be prepared to impugn a butter below that figure.

10660. Do you think a low number is absolutely required in view of the possibility that butters from high latitudes come into this country and that there is a tendency for these butters, or an alleged tendency for these butters, to show a low Reichert-Wollny number?—No. I think that the opinion held on that question cannot be sustained. Nothing is more remarkable than the improvement shown in the analytical data yielded by imported Swedish and Norwegian butters, even when regard is paid to the fall and spring of the year. Taking Russian butters, including Siberian, into consideration, there is no evidence from our record of Russian butters that their composition, as has been stated, is vastly and frequently abnormal. In my experience it is only of the rarest occurrence that the results are so low as to give rise, even to a suspicion, that the butter was not genuine.

10661. I think you have got some direct testimony in the case of Russian and Norwegian butters?—Yes, I have.

10662. Will you kindly tell the Committee what your testimony is as to the general character of Russian and Norwegian butters?—The allegation that Russian butters and butters from Siberia suffer from a natural poverty in the characteristic acids of butter does not receive much support from the results obtained in the Government laboratory in conection with the analysis of imported samples. During the last three years 190 samples of Russian butter, including those from Siberia, have been examined, and in only four or five instances were the samples regarded as outside the normal limit.

10663. By the normal limit do you mean that they fell outside your Reichert-Wollny figure of 24?—Quite so. Of the 80 samples examined during the past 12 months only one appeared to be slightly suspicious.

10664. How did you obtain these samples?—These samples were received through the sampling officers of the Customs.

10665. Did you obtain any special samples from anybody else of authentic Siberian butter?—Yes; a certain number of representative samples of these butters were obtained from a London house. I hand in the results (*Appendix XXXI.*) together with those of six samples of Siberian butter recently received at the Government laboratory from the Customs in the ordinary way, and not included in the samples I have just referred to. It will be observed that in no case does the Reichert-Wollny number fall below 24, and in only two cases does it fall below 25, whilst the other figures are of a fairly average character. The improvement noticed in the chemical composition of butter exported from Norway, and examined at the Government laboratory, is corroborated by the figures published by the

Mr. G. Lewin.

14 May 1902.

Government control station at Christiania, from which it appears that only in two dairies out of 21 were there any abnormal butters found. I have here the most recent statement from the control station at Christiania, and the results it gives are exceedingly important (*handing in a document*).

10666. Your general conclusion is, then, that a limit of 24 Reichert-Wollny would no more hardly hit Norwegian or Russian butters, including Siberian butters, than it would our own butters?—That is so.

10667. There are no more frequent occurrences of low Reichert-Wollny numbers there than in butters produced within our own isles?—That is so.

10668. I think Mr. Hehner admitted in evidence that there was no reason why Siberian butters should show any abnormality?—I understand that his latest view is in that direction.

10669. Have you anything to say in respect of the other chemical criteria which were applied to the butters that were gathered for us from various parts of the British Islands?—The specific gravity was the first physical test applied, and the figures so obtained are, on the whole, in very general agreement with the Reichert-Wollny figures and confirm them—in the large majority of cases, at once proving the genuineness of the butter without proceeding any further, especially when you take the Zeiss number—that is, the refraction—in combination. With the specific gravity and the refraction you have two very valuable criteria well qualified to guide a chemist in weeding out his samples. After ascertaining the specific gravity and the Reichert-Wollny number we took the percentages of the fatty acids—that is to say, the soluble acids were wholly washed out and estimated, the Reichert-Wollny number, as you will remember from former evidence, being deduced from the volatile acid found in the product of a definite but partial distillation of these acids. Then we have taken the molecular weight. We have done that because it may turn out useful in the future, but until it is read in the light of the various tests it is not quite clear what is the value of this test—*i.e.*, the molecular weight of the insoluble fatty acids. It has some relation to the other results, but its exact value is not very apparent at present. The Koettstorfer number, which is an expression of the saponification value of the whole butter fat, is one that is valuable, and is of a corroborative character. These exhaust the various tests that have been applied to the butters that were sent to us.

10670. Now you have had the opportunity of considering the evidence which has been tendered to this Committee by various chemical experts who have appeared before them, and I desire, with the permission of the Chairman, to examine you upon that evidence. We have had it in evidence before us, mainly from Mr. Hehner, that there is an important difference in the general character of the butter from cold and warm climates, but I believe Mr. Hehner has subsequently rather modified his view?—Yes, I understand that is so.

10671. Is there anything in your experience to corroborate the view that there is that difference?—No; and if anything was necessary to complete the evidence to the contrary it is to be found in the published list that I have just brought before the attention of the Committee. The figures there go far to show that the composition of butter fat from Northern Europe, including those from France, but excluding a few samples from Holland—that is from the Friesland district, which is the only doubtful country—is becoming more and more level, and I have little doubt that with the stimulus of an official limit, the generally uniform character of imported butters as to their maximum and minimum figures will become even more apparent. I think that the adoption of a standard will go very far to exclude the 1 or 2 per cent. in Norway and Russia, if they actually do exist. The Norwegian people have the matter entirely under their control; the dairies produce this abnormal butter at a certain season, and nothing would be easier than to bring in any doubtful sample of the kind for consumption in the towns of Norway.

10672. Do you wish the Committee to believe that there are absolutely no good grounds for the assertion that Siberian butter is frequently vastly abnormal?—I consider that there are no grounds whatever.

10673. Mr. Hehner strongly deprecated the adoption of any fixed limits, such as are contemplated under Section 4 of the Act of 1899, with reference to the authentication of the nature of the fat; he advised this Committee, in fact, that it had better hold its hand and rather wait for a fuller investigation. What have you to say about that?—He appears to advise waiting for a fuller investigation into the composition of butter fat before dealing with the limits. There is no reason for this, as, should a method be discovered which would directly determine the presence of added fats, no statutory limit would be required. It seems politic, therefore, in the meantime to adopt some barrier against indiscriminate adulteration by fixing a limit below which a presumption would be raised that the butter was not genuine, and it might in future be dropped in favour of the discovery of a direct method of detecting foreign fat.

10674. I think no one has had more experience in the analysis of butter than you have had; since the passage of the first Adulteration Act in the early seventies, you have given as much attention to this matter, I believe, as any analyst in the kingdom. Can you hold out any hope to this Committee, as the result of that experience, that any substantial improvement in the character of butter analysis is likely to be immediately forthcoming?—No, I cannot. I have had a long experience, and perhaps was the first worker on that particular branch of butter analysis dealing with the complex glycerides of butter, which is said to be the direction in which we may find the decisive test. I am not very sanguine of an early discovery of such a method, when it is remembered that the subject of butter analysis has been in hand for 28 years, and that a great deal of research in Europe and in America has accomplished little beyond perfecting the method which, from the earliest period of butter analysis, was adopted to determine adulteration.

10675. (*Sir Charles Cameron.*) I do not quite understand whether the reply you have just given applies to all the different methods of analysis which you have described, or to the Reichert-Wollny method, or to the determination of the soluble and insoluble fats?—I put them all together as being of a similar kind and character.

10676. (*Professor Thorpe.*) I think what Mr. Hehner laid down very categorically was that it was necessary to take an absolutely new departure, and that instead of fixing the quality of butter by methods which simply determine the characteristic ingredients of butter, namely, what we call the volatile acids, it was necessary to make an absolutely new departure and look for some method which directly determined the amount of added fat?—That is what I understood you to mean, and what I had in my mind in giving my answer.

10677. (*Sir Charles Cameron.*) You were thinking of the possibility of isolating the added fats?—Yes, Mr. Hehner's suggestion amounts to that.

10678. (*Chairman.*) Are you aware that at a recent Butter Congress, held in Brussels, the director of the Government Laboratory at Louvain, M. Graftiau, stated that he had received official permission to announce that one of his assistants had recently discovered a method which will probably settle the difficulty connected with the analysis of adulterated butter. He said that he firmly believed that the Gordian knot had been cut, but he could give no particulars, partly because the method was being tested under various conditions in order to corroborate the results already obtained; but principally because very valuable prizes had been offered in various quarters for the discovery of a method of this character, and it was manifestly inadvisable to give details. Do you anticipate any new discovery coming out of this announcement?—No, I should be very doubtful.

10679. You would not think it worth the while of the Committee to holds its hand until this discovery has been announced?—No, I do not think so. It would only be an additional factor if these added fats could be proved directly, and that would not interfere at all, as far as I understand it, with the legal position of the standard if we were to adopt a Reichart-Wollny limit of 24.

10680. (*Professor Thorpe.*) Dr. Dyer in the main was in agreement, I understand, with Mr. Hehner as to the vastly abnormal character of Siberian butter, and he too, I think, shrank from adopting a standard as a proof of the genuiness of butter?—Yes.

10681. I suppose what you have to say with regard to Dr. Dyer's evidence in that respect is identical with what you have said with regard to Mr. Hehner?—Yes, but I would take him in on my side, I think, because

Mr. G. Lewin.

14 May 1902.

he makes an admission which is very important. If it be true that butters from other countries than the United Kingdom do not show substantial differences between the miximа and the minima, then Dr. Dyer's admission that English butter might be controlled by a standard without serious difficulty should also embrace the butter of other countries, if anything like an equality of composition could be shown. I understand that Dr. Dyer would for British butters have a standard, and if other butters are comparable, in regard to the analytical figures, there is no reason why there should not be a universal standard established.

10682. Of course, Dr. Dyer, like Mr. Hehner and other witnesses, stated that if we adopt a limit at all, in view of the occasional occurrence of butters having a very low proportion of volatile acids, it would be necessary to adopt a very low standard, and that that low standard would allow, especially at certain seasons of the year, of the introduction of considerable quantities of foreign fat with impunity?—Yes, I believe he did.

10683. What have you to say with regard to that observation?—As to a low standard allowing of a wholesale adulteration, it is first desirable to know what he means by a low limit. The limit I have suggested, viz., 24, would not allow a more frequent or greater amount of adulteration than is the case with milk in regard to the proportion of separated milk which might be added under the limit of 3 per cent. of fat - that is to say, it would be as good a safeguard for butter as 3 per cent. of fat is for milk.

10684. Have you read Mr. Faber's evidence?—Yes, and also the report to the Danish Minister of Agriculture, which has been generally circulated amongst chemists.

10685. Have you any comments to offer to us with respect to Mr. Faber's evidence?—One of the most important admissions in his evidence is the adoption of the statement in the report of the Danish Minister of Agriculture, dealing with certain feeding experiments carried out in the months of September and October, the results of which conclusively show that the avoidance of low Reichert-Wollny figures is entirely under the control of the cow-keeper. I think the inference may also be properly drawn that where a cow is enduring physical suffering she is incapable of yielding butter of a normal character. The results which we obtained from the samples I have described weighed considerably with me in coming to the conclusion which I have stated, that anything under 24 is given by the cow when she is enduring physical suffering. The Danish people have proved it, and also the Norwegian people under Mr. Werenskiold, who worked out the matter some two or three years ago, as Professor Thorpe will remember. There the same conclusion was drawn, that when the cows were sent out from the byre to the hillside under severe climatic conditions down went the Reichert-Wollny figures.

10686. I believe that is extremely well illustrated in the numbers which are given in the last report from the Control Station at Christiania, in which these low Reichert-Wollny numbers are shown to occur most frequently in the early part of June?—Yes, and in the end of May.

10687. That is so; and in that period, in the very early spring, as Mr. Riple pointed out to us, when the cows are frequently turned out from the byres, at a time when there is frequently a considerable amount of snow, and also when there is not infrequently a considerable amount of rainy weather. I believe the numbers in the report indicate how immediately the Reichert-Wollny figure drops as compared with what it was when the cows were still housed and kept comparatively warm, and fed with good food. Moreover, in the early spring, on account of the snow, the cow has to wander over considerable ground in order to get the pasture which she wants, and therefore there is a great amount of physical exercise and a certain amount of physical suffering sustained by the beast under those conditions?—Yes. It is very noticeable, too, that whilst in 1899 the number of these abnormal butters reached seven or eight in about 200, there were only two or four in the same number two years afterwards. It is evident, therefore, that the Norwegian people are awake to this question, and are seeking a remedy.

10688. Does that conclude all you wish to say in respect to Mr. Faber?—Not quite. Whether the butter of the ill-treated cow is equal in quality to the normal butter of a properly cared-for animal, scarcely enters into the question before the Committee. At the same time I entirely dispute the statement, without further evidence, that these butters are of equal quality; in other words, that the butter of an ill-treated cow with a Reichert-Wollny number of 20 is equal to the butter produced by the same cow rationally or humanely looked after when the Reichert-Wollny number is 28. We know nothing of the digestive function which may be exercised by the soluble acids of butter, and until they are proved to be of little or no value, it seems to be only common sense to listen to Nature's record, and to assign the higher quality to the butter with higher figures, produced, as it is, by a cow living under healthy conditions.

10689. (*Sir Charles Cameron.*) You mean the higher figures for the peculiar fats?—Yes.

10690. (*Professor Thorpe.*) I believe you have also some remarks to make with respect to the table in Mr. Faber's report (p. 495)?—Yes. I would make the passing remark in connection with that table, which embodies the report of the judges upon dairy samples, that even on the basis of the empirical and inadequate tests of the butter judges, the greater number of the double figure values for character are assigned to the first fourteen butters with the highest Reichert-Wollny numbers; and no double figure is assigned to the last fourteen, which are those with low Reichert-Wollny values. So that even on this rather weak test, it would appear that the higher commercial value has generally been awarded to butters with the higher chemical values. The figures I have just alluded to appear in the report to the Danish Minister, and it is very striking that the high commercial figures are, most of them, opposite the higher Reichert-Wollny figures.

10691. That in other words, in your answer to Mr. Faber's allegation that there is absolutely no connection between the Reichert-Wollny numbers and the commercial quality of the butter?—Yes, even taking the commercial quality; whereas the dietetic value is one which is not touched at all by those judges; so I would remark that we had better go by the voice of Nature in a matter of that kind than by any empirical test of a Danish butter judge.

10692. (*Sir Charles Cameron.*) Do you not think that the influence of climate is a factor worth taking into account with regard to the amount of the peculiar fats in butter?—No; if the cow is well cared for it has no effect whatever. If you take the figures obtained from the cows at Sumburgh Farm, in Shetland, which is situated on a tongue of land which must be exposed to all kinds of wind, you will find that they are extremely even figures. This is a point that has not been brought out, that when the question of discomfort and physical suffering is referred to it has not been noticed that a hot summer must have the same effect to some extent as the opposite condition, and that anything which produces physical discomfort or suffering brings about a reduction of the figures. There is no reason why in July and August the figure should drop, unless that is due to climatic conditions.

10693. I merely asked the question because I thought you had said something about high latitudes in Scotland having an effect?—It has nothing to do with the climate; it is due to the condition of the cow and to the feeding.

10694. I thought you said with reference to the difference in Scotch butters that that might be due to some extent to higher latitudes?—What I meant was that even higher latitudes were not against the production of high figures.

10695. Do you think it is as easy, if not easier, to separate the volatile acids from the butter by distillation rather than by washing them out?—Yes, I have given my preference to distillation.

10696. When you get to myristic acid I have found that it requires a great deal of washing?—That is quite true, if you get very much out of it at all.

10697. Of course, the ordinary public analyst, who would have the greater number of analyses of butter to make, would much prefer the Reichert-Wollny method, so far as the expenditure of time is concerned, to the method of determining the soluble and insoluble acids?—Yes, I think a good many analysts fight shy of determining the soluble and insoluble fatty acids. Generally it would be a very important matter with regard to any test which might in future be found, that it must be something within the capacity of the analyst as well in regard to time as in regard to skill; and a very

Mr. G. Lewin.

14 May 1902.

lengthened, complicated, and laborious test would really not be practicable, even if, under special conditions, it might be of importance.

10698. In comparing the results obtained by, we may say, the analyst for the prosecution and the analyst for the defence, a concordance of result could be more easily ascertained by the Reichert-Wollny method than by the other, could it not?—Yes. I have found where I have given evidence in court, and have had the figures of the other side, that we agreed quite well in regard to the figures obtained, and that there was only a difference on the question of the deduction to be made from them.

10699. I have found, personally, that it took a considerable time to carry out the old methods of determining the soluble and insoluble acids separately by the washing-out process?—It is a very lengthened process.

10700. With regard to the low figures you have obtained, do you think that the number of animals which contributed the butter was sufficient to base very reliable conclusions upon?—I think so.

10701. With regard to that one very low figure of 20·6, have you any information as to the quantity of the butter there?—No.

10702. Was it butter made from the milk of one or two cows?—It was butter from the mixed milk of 17 Shorthorns, to which reference has already been made. The animals were out of doors during that month (December).

10703. They were placed there under improper conditions?—Yes, and immediately they were brought indoors the figures rose to 28·4.

10704. Supposing that a standard process was recommended, with the necessary re-interpretation of results, would it be a proper thing not to make that a perpetual standard, but to allow in the course of time of other methods that perhaps were found at least as efficacious if not more so, and perhaps more simple? How would you provide for the adoption of a generally approved and new method of analysis that might be found to be superior with regard to economy of time and to correctness of results?—There can be no reason whatever why an alternative method should not be adopted. Of course, as you will know from your experience, there is very little hope of anything further being done on the present lines of analysis. In regard to the method of determining the particular acids called the volatile acids, we have reached almost as fine a point as we can.

10705. I quite agree with that, but how would you provide for any improvement that may be forthcoming—the result of more extensive knowledge might lower your standard, for instance?—That would be a matter no doubt for the Board of Agriculture to consider.

10706. You would give them power to do so, and you would not fix a standard like the Laws of the Medes and Persians, as something that is never to be altered?—No.

10707. With regard to prosecutions, would you recommend that one method of analysis should be adopted?—Yes, that follows.

10708. And that in the case of prosecutions only that method should be recognised?—I am not quite prepared to say that, because the Reichert-Wollny number has so many corroborative tests to support it.

10709. Those would be supplemental?—Yes.

10710. You would not prescribe?—No, I should not prescribe one.

10711. And you would allow any other supplemental tests?—Yes, the analyst should not be debarred from taking any course that might help him in coming to a conclusion.

10712. (*Mr. Gibbons.*) I do not think you gave us the name of the other English dairy school where you found such abnormal results?—It is the Midland Dairy Institute at Kingston, Derby.

10713. Was the butter there found to be very deficient?—It began in May very well, but in July—and this is absolutely unique in the whole history of butter analysis—we had a figure of 22·5.

10714. Was there any explanation given of that?—No; my explanation is that that dairy was not properly conducted.

10715. (*Major Craigie.*) What is the number of cows there?—They had six Shorthorns. There is nothing exceptional about that dairy other than that the cows appear to have given a good deal of linseed and cotton-seed cake. That appears to be the speciality about their feeding; but as I say, I have never found a butter in July, coming from any farm whatever, with 22·5 before.

10716. (*Mr. Gibbons.*) I think you said that you found that the period of lactation produced little or no effect?—Yes.

10717. Did you mean in regard to all the constituents of the milk or simply in regard to the acids?—In the relation of these acids.

10718. I think in the early part of your evidence you said you had found that cows which were in exposed positions in Great Britain had their produce affected?—Yes.

10719. What was the nature of the difference you found in the produce owing to their being so exposed?—We might come back again to the Munster Dairy School. When the cows there were out of doors the Reichert-Wollny number was 20·6; in other words, the butter contained less volatile or soluble acids; but immediately they were put indoors the Reichert-Wollny number rose to 28·4, which means over one per cent. more of soluble acids in the one case than in the other.

10720. Would that not rather point to the fact that cows which were exposed in bleak climates would not show the same results in their produce that others would?—That is quite true. What I say is that that being a preventible cause, it is in the interests of the cow-keeper to act humanely and rationally towards the animal, and to see that she is kept under conditions which would produce the most favourable results.

10721. Would not the most natural condition in which a cow could be kept be that of keeping her out of doors and feeding her on grass?—Quite true. What I started with is this—to produce abnormal butter she must have been enduring physical suffering.

10722. Still, being kept under natural conditions?—I am not sure that they were natural—that is just where I would come in. If you were to draw the attention of farmers to it, you might inaugurate an era of emancipation for milch cattle from centuries of neglect and constructive cruelty.

10723. (*Sir Charles Cameron.*) I suppose the cows in the south were also on high grounds, where they were exposed to unusual cold; was it not an upland country where the cows were kept that produced this inferior butter in December with the low figure?—I think it is due not so much to the fact that it is an upland country as to the fact that the cows were exposed to a climatic condition which produced physical suffering.

10724. In many parts of Ireland the cows are out the whole year round, and you can see them out on the great central plains the whole year round, but they are not kept out where the ground is two or three hundred feet above the sea level?—I understand so.

10725. (*Chairman.*) Surely the point is perfectly plain—that where the cows have suffered from exposure the quality of the butter would have been improved in the respect with which we have dealt to-day if they had had adequate shelter. There is nothing more in it than that, is there?—That is what I mean.

10726. (*Mr. Dunn.*) You would, I think, fix as a limit a Reichert-Wollny number of 24?—Yes.

10727. You appear to consider that the Reichert-Wollny method is the only one applicable as a test?—Yes.

10728. Although the others may be useful for weeding out and for corroboration?—Yes.

10729. You base your opinion I think largely upon the figures which you have laid before the Committee to-day?—Yes.

10730. Have you noticed that 16 samples out of something over 100 in England, and I think seven samples out of 58 in Ireland, would be outside that limit?—Of course you will remember that I exclude the butter coming from those exceptional teaching institutes. I have not included them, and I do not think that your Committee ought to do so. Therefore my figures are scarcely those which you have quoted. I have four in Scotland and four in Ireland.

10731. Have you any definite evidence that those abnormal figures were produced as the result of special experimenting?—No. I leave that matter quite an open question. What I do say is that in July in one of these institutes we have 22·5, and there being nothing like that in my experience, or in regard to anything I have had in the past, I take it that there must have been something exceptional in the feeding or treatment of the cows.

10732. In any case, these figures were based upon herds of cows, were they not?—There are large and small herds.

10733. But they were herds, large or small?—In two or three cases there were only two or three cows, but those are rather important, because the smaller the number of cows the more likely is this question of the lactation period to be settled. They bear out what I said at the beginning, that the lactation period is a mere insignificant factor in regard to any alteration of the Reichert-Wollny number.

10734. The point I have in my mind is this: when you are dealing with herds of cows you get nearer to an average, as you point out with regard to the period of lactation, but when you are fixing a limit there is a greater danger of the limit being a hardship amongst the poor people who have only one or two cows, and consequently you cannot go strictly by the rule of averages?—No doubt under exceptional conditions one or two cows might give low figures, but the results that we have obtained do not bear that out so far as the results from small farms are concerned. Take the Somersetshire farm, at Sharcombe, Wells. The herd there consists of from eight to nine cows. Then at the Colonial College at Hollesley Bay—these are very significant figures—the number of cows being only six, and therefore it might be regarded as a small farm—their figures are remarkably uniform, the lowest Reichert-Wollny number being 28·2; almost all through the year the Reichert-Wollny number is nearly level.

10735. There are many farmers in Ireland, and, I suppose, in Scotland, with a much smaller number of cows than that?—We did a good deal some years ago in this direction, and we found, with very rare exceptions, that the small farms in Ireland with only two or three cows did not give exceptional figures.

10736. (*Professor Thomson.*) If a standard is fixed, you advise it to be fixed upon a Reichert-Wollny number?—Yes.

10737. There is at present no other material that can be taken for a standard?—No.

10738. Not even the refraction number?—The refraction number is of no value.

10739. (*Mr. Gilchrist.*) Did I understand you to state that some analysts, in giving evidence, not here, but in Court, had gone down to as low a Reichert-Wollny number as 20?—No; I said that this inquiry here has disclosed the fact that there are analysts who would go as low as 20.

10740. To come back to the table which you have been explaining to us, is it not the fact, as far as you can judge now from the figures, that 8 per cent. of those butters which you have analysed are under the Reichert-Wollny figure 24, which you think should be adopted as the limit?—Have you included the teaching institutes?

10741. I have included all the figures in the table?—Then I say yes, I have no doubt that is so.

10742. With regard to the figures from Newton Farm, Glasgow, is it not surprising that they should come from a low part of the country, where the land is not 50 feet above sea level, where the cows are particularly well cared for, and where during these months of August, September, and October, 1901, the weather was particularly mild?—Yes, it is remarkable.

10743. Would you not, therefore, in view of this exception to the rule, think it advisable to go a little further before adopting your figure of 24?—No, I do not think so; I think that the owner of this farm might very well improve his system. There is nothing in Scotland or England that quite compares with it. I cannot analyse the method pursued at the farm, but I should say clearly that it is capable of improvement in some way.

10744. Would you not like to test some other butters from the same district of Scotland before fixing a number in view of these figures? You see you have only got the Dunragit Creameries in the south-west of Wigtownshire from that part of the country?—There is Kilmarnock, which is not very far from it, and which is a very good set-off to the Newton Farm, though it is somewhat exceptional in being an agricultural college. From Kilmarnock we have very high figures—figures which entirely sustain the position I have taken up, and which throw out the Newton Farm figures as something quite exceptional in the history of farming in Scotland.

10745. (*Major Craigie.*) Following on the last question of Mr. Gilchrist, have you seen Mr. John Speir's evidence before this Committee?—No, I have not read that.

Mr. G. Lewin.

14 May 1902.

10746. He has given a full account of his own farm, and the various experiments he has made, and to some extent of the treatment of the cows on the farm; perhaps if you had the time to examine that evidence it might throw some light on some doubtful questions?—I should be very pleased to inquire into it, but of course the doubt may arise that the farm is over-experimented—in fact, that is just my fear.

10747. I gather from your answers to other questions that you wish the Committee to understand that where experiments have been carried on, as at Newton Farm, and at the Yorkshire College, and at the Dairy Institute at Kingston, all three being cases where special experiments in butter-making have been carried out, there is reason to expect something abnormal in the butter?—It is certainly my view that you may over-experiment.

10748. Where the stations are being used for research work the animals are not quite in the normal condition that they would be in if kept simply for producing butter which is to be put on the market?—That is so, and therefore I have tried to guard the Committee against accepting these results as criteria.

10749. (*Mr. Gilchrist.*) What are your reasons for that reply, in view of such a place as Newton, with its 60 cows, being carried on as a commercial dairy farm?—At Newton—I do not know whether it is significant or not—only six cows were specially assigned for this inquiry.

10750. In their selection and in their treatment can you suggest any theory as to why the Reichert-Wollny should be abnormal?—No.

10751. (*Professor Thorpe.*) It is most significant to us that six cows should be set aside from the whole farm. What we should prefer to have had would have been the produce of the whole herd; but why six cows were selected, and on what principle those six were selected, we have no information, I believe?—That is so.

10752. (*Mr. Gibbons.*) Have you found any difference in the acids owing to the breed of the cows?—No.

10753. You find the same results, then, with Shorthorns as with Jerseys?—Jerseys gave high figures, but the cow which gave the highest figure was a Highland cow which was fed upon the uplands.

10754. Exposed to natural conditions?—No. One of the reasons why I think Scotch cows give higher figures in summer is that the summer there is more temperate, and they do not suffer so much from the heat. That is one of the factors which I think will make the soluble acids go down. In a hot country in summer, exposed to a meridian sun, the cow is in such discomfort that the figures run down, I think, from that cause. At Sumburgh Head, in Shetland, the summer there, as I know, is equable, and it is a perfect paradise for the cow as regards her summer treatment. The consequence is that they have more level figures in summer there than we have in England.

10755. (*Sir Charles Cameron.*) Apparently you have no figures showing the influence of age upon the quality of the fats. I may mention that in the Glasnevin experiments some years ago it was found, as the result of several hundred examinations, that the richest milk was given by the cows near the expiration of the periods of lactation, and that the old cows gave far better milk than the young cows?—The age has not been included in these statements.

10756. (*Mr. Gibbons.*) Have you decided whether the milk of summer time, when the cows are enjoying the beautiful summer evenings, is different from that which they have produced during the day?—No, it has not come to that; but the general conclusion, I think, is so certain from the results that I have put the heat of a meridian sun amongst the grounds of discomfort.

10757. It would be very interesting to test whether the milk which is produced during the night would not be affected favourably?—This I have observed—that a cow does not change her butter from one or two days' special treatment; it takes about a week to take effect, and it takes about a week for the effect to pass off again; so that I am afraid in 12 hours we should not have anything to guide us in that respect.

10758. (*Sir Charles Cameron.*) Do you think that the very hot weather has as injurious an effect as the very

Mr. G. Lewin.

14 May 1902.

cold weather?—Yes. The great factor in this butter acid question is the discomfort the cow endures from excessive heat, and also from excessive cold.

10759. In Siberia, then, the cow must endure terrible discomfort, for the temperature in the summer there is very high, and the mosquitoes, I believe, give the cows a bad time?—I do not know.

10760. (*Major Craigie.*) With regard to the Dairy School at Leeds, the very lowest figure that you have in the whole of the list is the Reichert-Wollny number for October at that school?—Yes.

10761. I see there are two lines of figures against that particular school; what does that mean?—As I pointed out at first, that was the only farm from which we received duplicate samples. They apparently divided the herd.

10762. Were the animals treated differently; have we any information of any distinction between their treatment?—I noticed that there was nothing remarkable in the figures; they appear to have been all under the same influence, and they are not differentiated in any way.

10763. Were the numbers given in each group?—Yes. In one group there were three Shorthorns, and in the other group six. That holds good all the way down to January, when the six dropped down to five.

10764. What was the period of lactation in October?—The period of lactation then was five or six months.

10765. In all these three exceptional cases, the Garforth Farm, the Derby School, and the Newton Farm, the minimum figure appears at about the same period of the year—October or November?—Yes, with the exception, as I pointed out, that in the case of the Derby School the figure drops down in July, which is a most exceptional thing.

10766. But there the figure in October is lower than the figure in July?—Yes.

10767. (*Mr. Gibbons.*) I think you said that in the Somerset County Farm at Bickenhall, you found it as high as any?—Yes. The Somerset figures are quite remarkable for the evenness of their yield, thus supporting my view to which I have come, namely, that the lactation period is an insignificant factor.

10768. (*Sir Charles Cameron.*) One question about these extremely low figures with regard to Ardagh. Have specimens been obtained in April and May from Ardagh?—Yes, and they will be included in the table when it is completed. The Irish sampling did not begin so early as the others, but it is being carried on over the month of May.

10769. That is, at the present time?—Yes.

10770. So that we shall know whether it has figures more favourable than these very low ones of 21·6 and 23·5?—I have got further results which entirely support the view I have stated. The figure for Ardagh rises up to 27 in March, and at the end of March to 29·6.

10771. (*Chairman.*) Supposing that the Committee adopt your recommendation of relying upon the Reichert-Wollny test, and fix the figure at 24, what exactly would be the position of the other tests? Firstly, I understand they would be used in the laboratories in order, as you said, to weed out the samples and as confirmatory tests?—Yes, I think that they would enable the analyst to satisfy his mind. I have stated in my précis that though the physical and microscopical characters and other tests might not be included in the Regulation, they might still be useful in all cases in which they are corroborative of adulteration by giving the analyst assurance, in any particular case, of the validity of the conclusion drawn from the Regulation limit.

10772. Would they be likely to be used in the Courts as evidence?—I do not think so.

10773. (*Sir Charles Cameron.*) Analysts could be cross-examined on them, of course?—Yes.

10774. (*Chairman.*) Much would depend upon the way the Committee dealt with these matters in their report, and therefore I want to get your opinion as to how the other tests should be treated; you see it is a very important matter, as they might affect the decisions under the Reichert-Wollny test?—Yes, undoubtedly.

10775. (*Sir Charles Cameron.*) Would you not propose to give figures for the iodine absorption, for example?—No.

10776. The specific gravity I have always looked upon as being of the greatest importance, because its results are so concordant with the Reichert-Wollny results?—I think those are the two that really hang together, viz., the Reichert-Wollny and the specific gravity.

Mr. JOSCELINE F. WATKINS, J.P., called; and Examined.

Mr. J. F. Watkins, J.P.

10777. (*Chairman.*) I understand that you are the Chairman of the Petty Sessional Division of Watford, Herts?—I am.

10778. How long have you occupied that position?—I have been Chairman for eight or ten years, but I have been on the Bench for 30 years. Originally we took the chair by rota, and then I was appointed permanent Chairman.

10779. Of recent years have you had much exeprience of cases under the Food and Drugs and Margarine Acts?—We have had a considerable number of cases lately—more lately owing to the increase in the population in the neighbourhood.

10780. Have you had cases of Messrs. Pearks, Gunston, and Tee's butter before you?—We have.

10781. Have you seen the reference to this Committee and the Regulation which it is proposed to make under it as regards the percentage of water in butter, which comes into force to-morrow?—I have not seen the Regulation, but I have seen the reference to the Committee.

(The Chairman read the Committee's recommendation contained in their Interim Report.)

10782. The Regulation which has been issued to give effect to this is as follows: "Where the proportion of water in a sample of butter exceeds 16 per cent. it shall be presumed for the purposes of the Sale of Food and Drugs Acts, 1875 to 1899, until the contrary is proved, that the butter is not genuine, by reason of the excessive amount of water therein." With the recommendation and Regulation before you, I will now proceed to put a few questions to you upon the subject. Have you seen the evidence which was given before us by Mr. Mead?—Yes, I have.

10783. Are you generally in agreement with his view as to the meaning of the Sale of Food and Drugs and Margarine Acts?—I cannot quite agree with him upon all points. I think that on some points he sees greater difficulty than I should see with regard to adjudicating cases.

10784. First we will deal solely with the question of water. Do you hold that when a sufficient disclosure has been made to the purchaser, it does not matter what the quantity of water is or how much water may have been added to the butter?—Yes. Our Bench have decided that where a disclosure is made to the purchaser of the approximate quantity of water closely enough to satisfy us that there was no intention to deceive—then there is no offence under the Sale of Food and Drugs Acts.

10785. Supposing that a manufacturer purchases Colonial butter with, we will say, 10 per cent. of water in it, then supposing he adds another 10 per cent., but does not conceal the fact, or rather discloses the fact to the purchaser, then if an inspector asks for a sample of that butter and the same disclosure is made to him, and the case comes before you—would you dismiss the case on the ground that sufficient disclosure had been made?—I should dismiss the case.

10786. If the purchaser knows what he is buying, then the question as to whether the article is genuine or not does not arise, and could not arise in your Court?—Not with regard to the question of water.

10787. I am talking now solely of the question of water?—I understand so. We should dismiss any case brought against him under those circumstances. Where the purchaser has full notice and knowledge given to him of what he is purchasing, we hold that the defendant could not be convicted.

10788. Now will you look again at the words of this recommendation and note the assumption on which the Committee acted: I gather you hold that assumption to be correct as regards the state of the law at present. The law provides that in the case of butter over which prosecutions arise which contains above 16 per cent. of

Mr. J. F. Watkins, J.P.

14 May 1902.

water, the onus of proof that the butter is genuine will be left on the seller when the Regulation comes into force?—Is your question based upon the fact that this Regulation is supposed to be in force?

10789. Yes?—It would throw the onus on the defendant, certainly. I do not think it quite alters the state of the law sufficiently. If ample notice is given to the purchaser that he is purchasing butter with 25 per cent. of water in it, it is not to his detriment.

10790. Therefore you would not go into the question as to whether the butter is genuine or not, or as to how the excess has found its way into the butter if the purchaser was told that the water was there?—I think the decision of the Lord Chief Justice and of the two learned Judges who sat with him, decides that point. We had given our decision upon the point before. The Inspector of Weights and Measures and Foods and Drugs was prosecuting under the direction of the Standing Joint Committee of the County Council, and when we gave our decision dismissing the case, he asked for a special case, which we agreed to give. Whilst the special case was being settled, and before it had been submitted, the decision of the Lord Chief Justice, Mr. Justice Darling and Mr. Justice Channell was given. The prosecutor then in the case before us at once abandoned his application for a case, and said that he should not proceed with it. The Standing Joint Committee, of which I happen to be a member—though, of course, I took no part in it on this question—abandoned the case altogether, considering that that decision decided that if ample notice is given to the purchaser it does not matter how much water there is in the butter.

10791. But then this Regulation had not come into force. Would you say that matters will remain exactly the same as regards the effect of the disclosure after this Regulation has come into force?—Taking the Regulation as it stands, the defendant would be entitled to go into the box to show that the butter was genuine, and we could not stop him if he brought forward any evidence. The words "until the contrary is proved" give him power to produce evidence. Of course he would have to satisfy us that the excess over the 16 per cent. was the result of some accident. I do not quite know how he would prove it, or set up a defence.

10792. The point I particularly want to get your judgment upon is this: If the defendant has admittedly disclosed to the purchaser the full amount of the excess of water, is it still obligatory upon him to show that the butter is genuine?—I should say that in the face of this Regulation he would have to show that any increase of water—notice or no notice—was the result of something over which he had no control. I can hardly imagine a case. Negligence would not exonerate him from the effect of this regulation; only something in the shape of an accident, and I fail to see what accident could result in the addition of water to butter.

10793. Supposing that the water had been added through blending with milk?—I should hold that that was an infringement, and that that would be no defence.

10794. Then owing to the operation of this Regulation you are deciding the Pearks, Gunston, and Tee cases in an opposite sense to that which has commended itself to the Lord Chief Justice?—No, I do not understand that that is the effect. As I understand it, this Regulation not being then in existence, the Lord Chief Justice held that where a person purchases butter, and at the time of purchase knows that that butter is either adulterated or has an addition of water to it, or something of the kind, that that is not an offence. Of course these things require a little close consideration, but I should be inclined to say that a Regulation worded as this is would estop any defence of that kind.

10795. You think that it is the clear intention of Parliament that that kind of adulteration should be stopped when the law was completed by the making of the Regulation?—Yes. This is a Regulation that lays it down that butter shall not *primá facie* contain more than 16 per cent. of water. That would throw upon the defendant the onus of proving that where water was introduced or left remaining in the butter it was not purposely added thereto or negligently left in the butter in the making of it. Such an article should not be sold as butter.

10795. I suppose it is generally conceded that in the case of the Pearks, Gunston, and Tee butter there is no concealment?—None whatever.

10797. On the contrary, there is perfect disclosure?—Yes, there is a full disclosure—a notice given to the purchasers of the butter that they are purchasing an article which is a milk-blended butter.

10798. It is further stated to the purchaser that butter so made must necessarily contain a higher percentage of water than this Regulation would appear to contemplate?—Yes. I may say that the matter came before our County Council for Hertfordshire at our last meeting, and it struck me that the only way in which it could be got over was by the adoption of some distinctive name, so that it would be an infringement of the Act to sell any article containing more than 16 per cent. of water under the denomination of butter. Whether the distinctive name should be gained by the addition of any other word, such as "milk-blended," or by a terminal addition, such as "butterine," or anything of that kind, so that the public should not be deceived at the time of purchase, I do not say.

10799. (*Professor Thorpe.*) Do you think that if a person called his article "Churno," for example, that would be a sufficient exoneration?—I should think so effectually.

10799*. Do you think the prefixing of the words "milk blended," would sufficiently exonerate him?—I should prefer some other terminology. I would not say, where ample notice is given to a purchaser, "This is milk blended," that that was not a sufficient notice as the law now stands.

10800. (*Chairman.*) Do you mean as the law will stand with the Regulation added, or as it stood before the Regulation?—As the law stood before. I think that "milk-blended butter," or even "butter" alone without the words "milk blended," would be quite a sufficient exoneration as long as the vendors stated the approximate quantity of water that was introduced into the article.

10801. To-morrow this Regulation will be in force, and then, as I understand you, the procedure in your Court would change in this respect, that no matter how ample the proof of disclosure might be, if the article is sold as butter it would be necessary to prove that the excess of water had been introduced in a way which would be consistent with the butter being what you would call genuine?—According to my present view, I should consider that would be a case for conviction.

10802. You would then convict in a case of milk-blended butter where there was an excess of water?—Yes, in the case of butter with the addition of the words "milk blended," or anything of that kind. But I am not speaking with great confidence on that point. It is open to a very great deal of argument. I should certainly myself, wishing, of course, to see the sale of these things under their proper denomination, like to see the prohibition of the use of the word "butter" for anything that contains more than 16 per cent of water. That would effectually stop any deception, as they would have to sell the article then under some other name. Of course, if a person chooses to buy it under another name, no one is injured.

10803. (*Professor Thorpe.*) The suggestion to use the word "butterine" is, perhaps, liable to some misunderstanding, because in some countries that word has already got a distinctive significance. For instance, it is used in America as synonymous with margarine. Therefore I think it would be inconvenient to take a word of that kind and apply it to some particular article here?—Yes, it would.

10804. I presume, though, that you attach no importance to the suggestion of the word "butterine"?—No. The motion originally on the agenda of the County Council was that it should be sold under the name of "butterine," and I moved an amendment, which was carried, to the effect that it should be sold "under some other distinctive name."

10805. Then your amendment directly challenged the applicability of the word "butterine," did it?—Yes.

10806. The word "butterine" did not commend itself to you?—It did not, and that was the reason why I moved the amendment.

10807. (*Chairman.*) Have cases come before you dealing with other adulterations of butter than adulteration by water?—Yes; we have had cases where a mixture sold as butter has been found to contain a large percentage of margarine.

10808. You have had expert evidence before you?—

Mr. J. F. Watkins, J.P.

14 May 1902.

Generally we have had the analyst's certificate. In the whole course of my experience I have a recollection of but one case where the certificate was disputed. Then the sample was sent to Somerset House to be analysed by the Government analysts. That was only in one instance out of the many cases we have had.

10809. Had you the analyst in Court?—If a case is disputed the analyst is in Court to give evidence; he is always there for examination by the defendant.

10810. (*Professor Thorpe.*) Has it come within your experience that you would be assisted in the adjudication of such cases if you had analytical limits defined as to when a presumption that the butter is not genuine should be either raised or settled?—Yes.

10811. You think that that would be of advantage to you?—It would materially assist us.

10812. Of course, you have had experience of the trial of milk cases?—Yes.

10813. Have you found in the course of that work that the present Regulations of the Board of Agriculture have been of assistance to you?—Milk cases are the most difficult cases we have to deal with, but we have on our Bench one or two skilled men as magistrates who understand everything connected with the subject, so that we have not experienced any great difficulty in coming to conclusions.

10814. The whole matter has now been to some extent cleared up by the regulations, and my point is: Have those regulations been of assistance to you and your brother magistrates in adjudicating those cases?—We have not had any milk cases lately where the question has really been contested.

10815. (*Major Craigie.*) Recurring again to the legal position on which you have very kindly given us some advice, I did not quite understand whether you drew the distinction absolutely between the two defences which are open to a person brought before you in a case where there is too much water in the butter, one defence being that of notice to the customer and the other defence being that the butter is genuine. Do you draw a distinct line between those two?—I do.

10816. The Regulation that you are now looking at makes no alteration whatever in the law, does it?—No.

10817. It makes an alteration only then in the mode in which you proceed in Court?—Yes, that seems to me to be the case.

10818. There is no alteration of the law whatever?—I do not see that there is any alteration in the law. If an article is sold as genuine butter, and on analysis it is found that there is a greater quantity of water than there ought to be, we should consider that an infringement of the Act. If, however, it is sold as butter, with notice to the purchaser that there is a certain percentage of water in it, then the purchaser knows what he is buying, and there is no offence.

10819. In fact, I may put it that, under Section 6 of the Act of 1875, the purchaser has received a substance of the nature and quality he demanded?—Quite so.

10820. And, that being the case, there can be no other question raised?—That is so.

10821. The vendor is not, therefore—Regulation or no Regulation—required to justify that sale at all?—No.

10822. Because there is no fraud in it?—Quite so.

10823. Therefore there is no offence against the Sale of Food and Drugs Acts?—None whatever.

10824. Under the law, as you read it, there is no such thing as a definition of butter; it may be any other substance; but the essence of the offence must be that the purchaser is deceived?—That is it.

10825. If the purchaser is not deceived the operation of this Regulation does not come before the Court at all, does it?—No.

10826. The Court, in fact, could only act on this Regulation when you come to the stage suggested by Section 4 of the Act of 1899—that is, for a defence on its merits?—Yes.

10827. What I really want to get from you is, what is the practice in your Court?—Under this Regulation the analyst's certificate would be put in, and if that showed that there was an excess of water, and that the article was purchased as butter without any statement that there was an excess of water in it, or anything of that kind, the defendant would then be called upon for his defence. I do not see what defence he could set up. If it was proved that there was this excess of water in the butter, then it would be clearly to the prejudice of the purchaser, who was supposed to purchase butter with only that quantity of water in it which properly made butter would be supposed to contain; and if there is an excess, it would be an excess either left in or introduced into the butter purposely with the intention of fraud, to the detriment of the purchaser.

10828. Then the point is really this: that under Section 4 of the Act of 1899 you have now sitting in Court something to help you in deciding whether the accuser or the defender is to give evidence as to the genuineness of the butter?—Quite so.

10829. But until that point is reached in which the accused is put on his defence, you would not look to this Regulation at all?—No.

10830. Therefore the question of notice to the purchaser would be raised before you went into the evidence?—The first question is: "What did you ask for?"

10831. And that being decided in favour of the defendant, the Regulation would have no effect?—That is so.

10832. Now I come to the discussion in the Herts County Council to which you have referred. This discussion took place after the report of this Committee was made public, did it not?—It took place a week ago last Monday.

10833. And therefore after the publication of the terms of the Regulation, so that the County Council of Hertfordshire resolved on something more than the Regulation, namely, that legislation was wanted. The object of discussing this matter was apparently that as a County Council you were not satisfied with the Regulation, but you wanted an alteration of the law which no Regulation could effect?—Yes.

10834. And that alteration of the law, in the opinion of your County Council, was to give a new definition to the substance known as butter, or to require that any substance known as butter shall have a certain percentage of moisture and no more?—Yes.

10835. That is really the position you took up?—Yes, and I think I may say that it is the opinion of most of the county magistrates whom I know. They want to see butter defined as an article that shall not contain more than a fair and proper amount of water in it, that it shall be kept as pure as possible, and that it shall be protected by its being made an offence to call any article containing more water by the name of butter.

10836. What are the analogies that tempt the County Council to ask for legislation with regard to that particular commodity?—Take whisky.

10837. Would you like butter treated in the same way as whisky is now?—I think so. A person is not allowed to sell whisky of less than 25 per cent., I think it is, below proof.

10838. The moisture in tobacco would be another case, would it not?—Exactly.

10839. Is it your idea that butter should be put on the same footing as those Revenue articles are, by special legislation?—Yes.

10840. And that Parliament should be asked to affirm what is butter?—Yes.

10841. What other substances not matters of Revenue are there in which Parliament has taken that step; do you know of any?—No; and I suggest it in regard to butter, because it is such an important element of everyday life.

10842. You have many more cases of butter adulteration than of the adulteration of any other kind of commodity?—We have very few cases of any other kind of adulteration; butter and milk are the only two articles that one wants protected in that way.

10843. That is putting aside spirits and beer?—I do not recall to mind ever having had, during 30 years, a case of spirits of any kind.

10844. Nor of beer?—Nor of beer; and we have a very active officer.

10845. You concur with the County Council in making the suggestion that an alteration of the law is required to put matters on a proper footing, even although this regulation has been issued?—That is my clear opinion on the subject.

10846. (*Professor Thorpe.*) I suppose you will acknowledge that the cases of whisky, tobacco, and beer are in some respects anomalous in so far as they are articles of revenue?—Yes.

10847. As you are aware we obtain a very large proportion of our excise from tobacco, spirits, and beer?—Yes.

10848. The Legislature has laid it down that tobacco shall contain only a limited amount of water in order to protect the tobacco revenue?—Certainly.

10849. It has also laid it down that whisky shall not be sold too dilute, because, of course, the spirit revenue must be protected?—Yes.

10850. It has also enjoined that beer must be sold of the gravity issued by the brewer and not be diluted by the publican, in order that the beer duty shall be protected?—Yes.

10851. The analogy is surely not perfect when you extend it to butter?—I admit that it is not perfect, but whether it would be advisable or not in the interests of the public generally is another question.

10852. The class of considerations which have led to statutory limits in these cases surely does not apply to an article like butter?—It would not apply under those circumstances. But the question is whether any steps should be taken, and, if so, what steps should be taken to prevent what one might call the adulteration of butter by the excessive addition of water. If this regulation in itself is not sufficient, should it not be made so?

10853. I wish to point out to you upon what a limitless field you will embark. When you require that an article like butter, an ordinary article of food, should have something like a statutory definition of quality attached to it, you also ask implicitly for the same thing to be attached to every other article of food of variable composition. There is no reason, for example, why you should not ask for a statutory definition of cheese?—Is there not a definition for drugs, for instance, which ought to be compounded as directed in the Pharmacopœia?

10854. The Pharmacopœia is not statutory?—I know it is not statutory, but we take it as evidence. If any drug that is sold is compounded in a way different to that prescribed in the Pharmacopœia, and there is an introduction of unwarranted articles into it which destroy the efficacy of it, we take that as strong evidence. The Pharmacopœia gives a definition of the drug, and this Regulation, I presume, woul dgive a definition of butter?

10855. The Pharmacopœia, although its issue is under the direction of the Medical Council by Act of Parliament, has no legal binding force upon you. It is perfectly true that you and all other magistrates take the Pharmacopœia for the purposes of adjudication and for the purposes of justice as expressing what a Committee comparable to this Committee has ordained that certain drugs shall consist of; but it has no other force than that?—Undoubtedly it has no statutory force, but we take it as giving a definition by the best authorities available of what the particular drugs ought to be.

10856. But even in connection with the Pharmacopœia, may I point out that if due notice is given that this medicament or medicine is not an official preparation the person selling it is not exonerated?—There is no doubt about that. It all turns upon that question, with deference, whether the person knows what he is purchasing or not. If a person sells an article as butter, declaring it to be butter when it is not butter according to the general acceptance of the term, namely, butter properly made, and wthout intention to defraud the purchaser, then there is no defence. But if a person buys an inferior article, and has notice that he is buying an inferior article, I fail to see where there is any offence at all.

10857. What is the abstract or ethical desirability that there should be this tolerance and latitude given to a vendor in an article like this? What is the desirability, for example, to anybody concerned, except possibly to the seller of the article, that butter should be loaded up with an extraneous substance like milk or water?—It is a matter of taste. Only the other day a man said to me: "I have used this butter; I buy it, and I like it; it is excessively palatable. But I do not use it with the idea of its being kept in my house for two or three days, because it will not keep. This butter, when fresh, is most delicious to the palate. The only fault I find with it is that it is too extravagant, because one consumes so much of it."

Mr. J. F. Watkins, J.P.

14 May 1902.

10858. It seems to me that it is inconvenient in the public interest, and it is inexpedient in the public interest, that there should be any tolerance of the suggestion that a thing of this kind should be allowed to be made, because, as you pointed out yourself, it is not wholly to the interests of the consumer of the butter, because this so-called milk-blended material is an extravagant form of purchasing and of eating butter. If you are, in consequence of the existence of a manipulated article like this, to enter upon a course of defining every article of food which may be similarly compounded and regulating for every article of food statutory limits of quality, you will be opening a limitless vista of difficulties?—I cannot dispute that.

10859. Therefore the shortest course would be practically to say that articles of the nature of milk-blended butter should not be made?—Should not be sold under the name of butter. The Legislature have already interfered with regard to this question, and it is a question whether they have gone far enough. They have already taken upon themselves to define, to a certain extent, that the articles sold should be genuine according to the generally accepted use of that term—at least, that, I apprehend, is the intention of the Legislature.

10860. I suppose milk-blended butter cannot be considered really, by any stretch of the imagination, as genuine butter?—I am sitting here in two capacities—I am sitting here as a magistrate and as a private individual. Personally, I see no objection to milk-blended butter being sold and being bought by the public, as long as they know that it is sold as milk-blended butter, and as long as they know what they are buying.

10861. (*Chairman.*) The Committee are a little bit puzzled as to what exactly in your mind is the effect of this Regulation. I think you stated to Major Craigie just now that, Regulation or no Regulation, supposing a sufficient disclosure is made, the case would be dismissed; if that is so, I do not see that this Regulation has any force whatever?—If a disclosure is made, that would be so; but then it turns upon that point. If a disclosure is made, I should hold that there was no offence; but if a disclosure is not made, then this Regulation defines that butter containing more than 16 per cent. of water is not a genuine butter, and any extra water that is in it must be accounted for. That is the view I take of the distinction between the two cases.

10861*. Parliament has provided that when this Regulation comes in force the presumption shall be raised that the butter is not genuine if in the butter there is found more than 16 per cent. of water. Now you say that no presumption will be raised, or, at any rate, that the presumption will at once be dealt with and removed if a sufficient disclosure has been made?—Yes. I say if a disclosure is made the Regulation goes by the board—that is, if the seller tells you you are not getting butter with 16 per cent. of water in it only, but you are getting something else, and he sells it to you as something else, and you have agreed to take it.

10862. This state of the law, as you have described it, is really brought about by Section 6 of the Act of 1875, is it not?—That is the section which treats of the prejudice to the purchaser in regard to the substance not being of the nature and quality demanded. I think that section undoubtedly protects the seller in this direction.

10863. (*Sir Charles Cameron.*) Under all circumstances, do you think that a declaration of the actual nature of the thing is a sufficient protection for the vendor, no matter what is asked for, if another thing is given instead of that?—Provided it is nothing deleterious; as long as ample notice is given, and the purchaser knew what he was purchasing.

10864. If the purchaser asked for a certain thing which he thought he ought to get, and something else was given to him with a declaration of what it was, whether he was an officer purchasing for the purpose of analysis or an ordinary purchaser for his own consumption, no matter what the article may be, or how much it differed from what the article asked for was, or ought to be—if there was a declaration the vendor would be

Mr. J. F. Watkins, J.P.

14 May 1902.

protected?—Unless it came under one of those Revenue cases.

10865. Or unless there is a special law such as there is in the case of margarine?—Exactly.

10866. If a person asks for margarine, and gets margarine containing 20 per cent. of butter, and a declaration is made that it contains 20 per cent. of butter, would that save the vendor, in face of the fact that the Act of Parliament states that it shall never contain more than 10 per cent. of butter?—If it was sold as margarine I should say not.

10867. Notwithstanding that there was a declaration by the vendor in that case?—I should still say not. As I understand it, there is specific legislation declaring what margarine shall contain.

10868. What applies in the case of that specific enactment to margarine could be made to apply to butter, could it?—That is the point.

10869. And that is what you think ought to be done?—Yes.

10870. That there should be a specific prohibition of the admixture of milk with butter?—Yes, if the article is sold as butter.

10871. Apart from that, the addition of milk to butter cannot certainly be otherwise than a fraud—it is obviously a fraud to add milk to butter, because it in no way improves butter to add milk to it?—The purchaser becomes a party to the fraud if he chooses to take it so.

10872. A person may sell a mixture of butter with any other article, milk or cheese, or anything he likes, providing that he declares it?—Yes.

10873. I understand you think that the word "about" would enable the vendor to sell an article with a large quantity of water?—With regard to that, we had one particular case of the purchase of butter where the notice said that it contained "about" 22 per cent. of water, and the analysis showed that it contained 24 per cent.

10874. If the water went up to 25 or 26 or 30 per cent., would the word "about" protect the vendor?—No, not then.

10875. "About" would mean in, or close to, the proportion declared?—Yes; if you get up to 30 per cent., or anything of that kind, *primâ facie* it is a case of fraud, and the vendor would not be selling the article he professed to sell.

10876. If under ordinary circumstances vendors are held to the 16 per cent. specifically, why should there be so great a variation allowed in their own declaration to the contrary as 4, 5, 6, 7, or even 8 per cent?—Because Section 6 of the Act of 1875 says it must be "to the detriment of the purchaser." It is no detriment if a man chooses to accept such an article. He goes to the shop for butter, and if they say, "We can only sell you this butter, which has got 25 per cent., or about 25 per cent., of water in it; if you like to take that you can take it"; and if he then takes it and pays for it——"

10877. In a case where a prosecution occurred for the sale of butter containing 18 or 20 per cent. of water, would you allow the vendor to go into the box to show that it could not be made with a less proportion than that?—I apprehend that where a percentage of water is allowed by Regulation, I should assume that that Regulation had been made after the fullest consideration of all the circumstances, and that the best evidence had been taken before that quantity had been arrived at; and therefore, speaking personally, I should suggest to the person who attempted to set up a defence of that kind whether he thought it was worth while to go on with it.

10878. But you would allow him to go into it if he wished?—I am afraid I should be compelled to do so; you cannot very well stop a man.

10879. You would allow him to go into the question of the manufacture of it?—Yes.

10880. It would be trying it almost over again?—I think it would be almost an impossible thing for any man in his senses to try to persuade a bench or a single magistrate where more than a reasonable amount of water had been found in the butter. I apprehend that this Regulation has been well considered, and that it is not tied down to the very highest class of butter, or anything of that kind; but that due allowance has been made for the general run of butter.

10881. Would it be open to magistrates not to allow evidence to be gone into to show that the butter was genuine?—I am afraid we should be putting ourselves into a false position if we absolutely refused to listen to the evidence, but I think that such evidence would have very little or no effect, unless, of course, it was evidence of the very highest class. We should naturally assume that a Regulation by the Board of Agriculture was a well-considered one, and that the very best evidence supported it.

10882. In the face of that Regulation, you would not, perhaps, give so much credence to evidence purporting to show that it could be made genuinely with this excessive amount of water, as if there was no such Regulation before you?—I would give very little credence indeed to it.

10883. (*Professor Thorpe.*) What does "sufficient disclosure" mean? Sufficient disclosure must have some reference to the capacity and intelligence of the person to whom the disclosure is made?—It might be a case of quite a little child being sent to purchase a quarter of a pound of butter, we will say, at a shop. The question then might arise, but the answer to such a question would be, "Why send such a messenger, who is incapable of understanding?" You would at once get that reply.

10884. Supposing you sent an adult; even then a disclosure, which might be perfectly intelligible to you, and perfectly intelligible to the advocate leading the case, or to anybody concerned in Court—because we understand the meaning of words—might not be ample if the messenger were an ignorant labourer or an ignorant labourer's wife. I cannot help thinking that the term "20 per cent." means nothing to such people?—It would be a question really of fact for the magistrates to determine, whether good and sufficient notice had been given. They would take that, and they would be entitled to take that, into consideration upon the question whether the notice was given in such a way. One case I recollect which bears a little upon that point. A man was prosecuted for selling whisky that was adulterated with water; his plea was that a notice was hung up at the bar. The evidence showed that it was true that there was such a notice; but the notice was put up opposite the bar, and surrounding it were a whole lot of framed advertisements, so that you might be looking at the notice and yet not see it. We held that there was no notice at all given. It is really a question of fact whether a "proper and sufficient" notice has been given to the purchaser—if we find that it has been slurred over in some way, we should consider that that is not a sufficient notice; but then that is quite a question of fact.

10885. Would your Bench rule that what was sufficient notice to me would not be sufficient notice, we will say, to the ignorant labourer's wife?—We should take everything into consideration.

10886. Would you take that into consideration?—Certainly; we should take everything into consideration. If a person went in and asked for butter pure and simple, and was offered this variation from butter, as I might call it, we should require full and satisfactory evidence that the notice was properly given to the intending purchaser.

10887. Properly given in the sense of being intelligible to her?—Yes.

10888. (*Major Craigie.*) Supposing the purchaser were both blind and deaf and could not read, then she could not receive that notice?—No.

10889. Would you hold that she had had no notice?—If she was blind and deaf, of course, it would be very difficult to convey the notice.

10890. (*Mr. Dunn.*) She would not be a good messenger, then?—No.

10891. (*Major Craigie.*) It would not be sufficient to say she could not read and was deaf?—I think *caveat emptor* might apply there.

10892. (*Mr. Gilchrist.*) Referring to the motion about butter passed by your County Council, I see it reads: "That the President of the Board of Agriculture be, and he is hereby requested to introduce a Bill into Parliament providing that milk blended with butter and other mixtures" ——I was wondering whether it ought not to be "butter blended with milk"?—That was not my motion at all, and I am not responsible for it; I am only responsible for the amendment striking out the word "butterine."

Mr. J. F. Watkins, J.P.

14 May 1902.

10893. It strikes me it is a clerical mistake?—Yes, I think it must be.

10893.* I am referring to it for the purpose of another question. You agree with the resolution requiring that butter blended with milk, as I will put it, and other mixtures containing butter shall be sold under some other distinctive name?—Yes.

10894. Take the case of pure butter containing 18 per cent. of water—2 per cent. more than the standard fixed by the Board of Agriculture—would you insist that such an article should be sold under another name?—Not if the excess over 16 was so trifling. We do not act in strict accordance with the law, we exercise our discretion; we would say this is so close to it that we cannot do it.

10895. Supposing there were 20 per cent. of water in it, would that excess of 4 per cent. be too high?—Unless it was shown that the extra water was there by some unaccountable accident we should hold that that was an infringement of the Regulation

10896. I think you have stated that you could hardly conceive of any instance where evidence might be led in defence to prove that a butter containing so much water was a genuine butter?—Yes.

10897. Supposing I were to say to you that we have had witnesses here who have told us that under certain climatic conditions, warm weather, for instance, the water could not be taken out of the butter so as to leave a smaller percentage than 20 without injuring it by hurting the grain; would you consider that a sufficient reason?—I should not. I think that we, sitting as a Bench of magistrates, should hold that we could not accept that as a defence. We should hold that the matter had been properly considered at the time the Regulation was made and that all climatic influences and those things had been taken into consideration; and therefore we should not admit that as a defence—at least, that is my opinion, speaking for myself.

10898. You will notice that our Recommendation says: "On the assumption that butter containing a larger percentage of water than 16 per cent will escape the operation of this limit, provided that a sufficient disclosure is made to the purchaser." Would it not be a hardship for the Irish firkin butter (which has been stated to us to contain often 18 to 20 per cent. of water) if according to the idea of your Council it were required to be sold under another name?—Any evidence on that point, I think, would more properly come from someone else; my evidence on that would be, I think, valueless.

10899. (*Sir Charles Cameron.*) Would you deal with the case of the admixture of milk with butter in the same way that the matter was dealt with before any Regulations were proposed to be made, that is to say, having regard to the reasonableness of the amount of water present in it? I know of a case, for instance, where there was 49·8 per cent. of water; if a case of that kind came before the magistrates, would they think it an unreasonable amount of water to be found in a mixture of butter and milk?—We had a case before us where this milk-blended butter was declared to the purchaser to contain about 22 cent. of water; on analysis it was found to contain either 24 per cent. or something under 24 per cent. The majority of the Bench held that that was an excessive quantity, and the minority—of whom I was one—held that when the word "about" was used 2 per cent. or something under was comprised in the word "about," and that therefore it was not excessive. When you get beyond that amount, say up to 30 per cent., or 4 or 5 per cent. beyond the declared quantity of water, we should hold that the defendant was liable.

10900. Without any specific declaration?—Yes; if the declaration said that there was only "about" a certain percentage, and if the percentage was materially higher we should hold that the defendant was liable.

10901. If the statement was that the mixture was composed of equal parts, say of butter and water, could it be legally sold—that would mean, recollect, 50 per cent of water? I apprehend it could be sold legally, but it would depend entirely upon the circumstances under purchaser ought to inquire.

10902. Would that general statement do?—A general statement that it was butter and water would be sufficient.

10902.* It would be sufficient?—It is a case where the purchaser ought to enquire.

10903. (*Mr. Gibbons.*) There is no doubt that the nature of the disclosure by the seller to the buyer is a important point?—Yes.

10904. Would you consider the fact that the butter was wrapped in a paper which stated that the butter contained more than 16 per cent. of water, or that it contained a certain percentage of water, would be sufficient?—We have had that very point before us in a case that we decided. The question is whether a notice on the paper in which the butter is wrapped is of such a nature that it must necessarily strike the eye of the person who takes it. If a person asks for half-a-pound of butter and pays for it, and gets the butter delivered in a paper on which this notice is printed, and that paper is just wrapped round the butter, and it is perhaps handed over casually, then we should not hold that as a sufficient notice. If the article asked for is other than the article supplied and the only notice they say they gave is wrapping the article up in a paper containing the notice, we must be satisfied that the person accepting that article has full and ample notice of the contents of the paper in which it is wrapped. Nobody dreams of looking at a particular paper in which, say, a packet of buns or anything of that kind is handed to you in a shop; and we should not consider, unless it was clearly brought to the notice of the purchaser, that the article supplied was the article asked for.

10905. Supposing the buyer was informed: "This butter does not contain as little as 16 per cent. of water," and he is served with butter that is found to contain 20 per cent. of water, would that be a sufficient disclosure to him?—I do not think so.

10906. Then you would really hold that the buyer must be informed somewhat very close to the actual amount of water in the butter?—Undoubtedly.

10907. That every buyer must be so informed?—Yes. Where there is a variation from the 16 per cent. the vendor of the article must give the purchaser such a description of the variation as would not mislead him as to what he got.

10908. And a notice hung up in the shop would not be a sufficient disclosure?—That would depend entirely upon whether there was clear evidence that he must necessarily have seen the notice or that the notice was drawn to his attention. It is all a question of fact. I may say in general that ample notice must be given to the purchaser where there is a variation from the article that he has the intention of purchasing. It must not be slurred over in any way; we must see that the purchaser knows fully what he is buying.

Professor Dr. von BUCHKA and Professor Dr. P. VIETH, recalled; and further Examined.

Prof. Dr. von Buchka and Prof. Dr. P. Vieth.

10909. (*Professor Thorpe.*) (*To Dr. von Buchka.*) There is one point which on reconsideration of your evidence yesterday we should like to have made clear. Throughout your evidence you made use consistently of the term "Reichert-Meissl number"; do you regard that as synonymous with the Reichert-Wollny number?—Yes.

10910. You mean that you take for the determination of the Reichert-Meissl number 5 grammes of melted fat?—Yes.

10911. The Meissl number as you are aware, is based on 2½ grammes?—Yes.

10912. But you take 5 grammes of butter-fat?—Yes.

10913. I think Dr. Vieth told us yesterday that he was the principal at the Dairy Institute at Hameln?—(*Dr. Vieth.*) Yes; that is an institute which contains a dairy school and a laboratory. I am also consulting dairy chemist for the province of Hanover.

10914. How long have you occupied that position?—Since 1893.

10915. You were formerly in England, were you not?—I was in England from 1880 to 1892.

10916. What position did you occupy then?—I was analyst to the Aylesbury Dairy Company.

10917. Then you have had a very considerable experience in the analysis of milk and of butter?—I have

Prof. Dr. von Buchka and Prof. Dr. P. Vieth.

14 May 1902.

devoted the last 26 years almost exclusively to this subject.

10918. You attend here by request of the German Government, I understand?—Yes.

10919. What is the nature of the evidence that you wish to bring before us?—I thought it might be of some interest to the Committee if I told them some of my personal experience as to the chemical composition of butter, and I was anxious to correct a few statements which have been made before the Committee by Dr. Gissel.

10920. Perhaps it might be convenient if you were to give us the information you have to convey to us respecting English butter. Perhaps there is no essential distinction between the butter of England and the butter of the rest of the world?—As far as the composition of the butter-fat goes, I do not think there is; at any rate, I found while I was here in England butter-fats containing a rather low amount of volatile acids.

10921. Would you say that English butter was characterised by containing a rather low proportion of volatile acids?—No; I do not think so. I will tell you how I came to find those instances. I was asked by a brother analyst to send him one or two samples of butter of undoubted genuineness. I thought the best thing I could do was to make the butter in my laboratory myself; so I took two samples of cream which came from two different sources, and churned it in the laborotary. When I analysed that butter I found that in the one case the Reichert-Wollny number amounted to something like 28, and in the other case it was something like 22, and that was the case of a cream which came from the Aylesbury Dairy Company's own estate near Horsham.

10922. (*Chairman.*) At what time of the year was this?—It was early in February, 1889. I became very much interested in the question and had samples taken. I got a couple of gallons of milk from each supplier to the Aylesbury Dairy Company—the company was then receiving milk from 35 farms. That milk was churned in the laboratory, and then I had it analysed. Among the 35 samples I found in two instances Reichert-Wollny figures below 25. The lowest figure I think was 24. At any rate, a duplicate sample gave 24·2 and 23·9.

10923. (*Professor Thorpe.*) That would be a mean of 24?—Yes. I then looked more closely into the butter-fat from Horsham. There were three different herds—Shorthorns, Jerseys, and Kerries. The milk was kept separately, and I found that there was no marked difference between the butter coming from the different breeds. The Kerries, I think, were somewhat higher, but they were all low figures. That went on up to April; then the volatile acids rose to 25. I did not continue to keep the milk of the three sets of cows separate, because I found there was no difference in it. This state of things went on up to August, I think, and then the Reichert-Wollny number fell down again below 25. I took samples regularly once a week for a second year, and found very much the same results—that is to say, the Reichert-Wollny number was 25, or above, from April to July and from August to March it was below that. These cows were housed and were fed in the regular way. They got a good deal of silage, and I had the silage taken away to see whether that made a difference, but it did not. They then got a good deal of oats, and I had the oats taken away and replaced by wheat and barley, but that made no difference. Then I had the cereals taken away altogether, and that made no marked difference; so I really had no means of finding out where the reason for the difference lay. That is my experience regarding the English butter.

10924. What was the age of the beasts in that particular case—were the cows young or comparatively old?—There were cows of all sorts of ages, but they were certainly not particularly old; they were kept as milking cows, and so they were in the best milking condition.

10925. Have you had regard to the possibility of the age of the cow affecting the Reichert-Wollny number?—I do not think that there is any evidence showing that the age of the cows influences the composition of the butter-fat.

10926. In this particular instance was regard paid to the period of lactation of the cows?—It was. They calved all the year round. I found out the staler cows and the younger cows in lactation, and I put each class together, and I found to a certain extent that when the cows got stale the volatile acids fell down. When I noticed that I took the milk from two very stale cows, and found in these two particular instances very low figures, coming down in one instance to 15, but I do not propose to put any stress upon that, because it was really an abnormal case.

10927. When the cows are getting dry, I believe it is then that the proportion of volatile acids in the fat is, as a rule, very low?—Yes, I believe that is the only well-established fact which we have on the whole question. At the time when I made these investigations the Aylesbury Dairy Company bought a good deal of butter in the market, including French, Danish, and Schleswig-Holstein butter. I analysed all the butter which was bought, and found that a butter which came from a particular dairy in Schleswig-Holstein at a certain time of the year had very low figures. In the following year I asked my friend, Dr. Schrodt, then principal of the Dairy Institute at Kiel, to follow the matter up. It was butter which was quite beyond suspicion, and came from a large private dairy of 200 cows belonging to the Count of Holstein. My friend had samples taken once a week for the whole year, and the results were practically the same as I had obtained, *i.e.*, in the autumn there were very low figures. The same thing occurs in other parts of Germany over and over again.

10928. What do you mean by very low figures?—Figures coming down to 23 or 22. In East Friesland, and, in fact, in all parts of the province of Hanover, on the shore of the German Sea, at certain times of the year they have to deal with butter giving very low Reichert-Wollny numbers, more especially in the later part of the autumn, in September and October. I have made systematic investigations into this matter during the last three years, and I find that every year the same thing occurs. The samples I get from East Friesland come from large dairies which work up about 4,000 gallons of milk every day; so that in those cases it is not a question of the milk of a few cows or of a single herd of cows, but the samples are taken from the mixed milk of hundreds of cows. The same thing has been found in Mecklenburgh. Before I came to England I was for four years at a dairy institute in the Grand Duchy of Mecklenburgh. There was no Reichert-Wollny process then, so we analysed the butter by the Hehner process. Hehner, I think, put 87·5 as the limit for the insoluble acids. At times I found figures which agreed very well with Hehner's, but at other times of the year I found figures which did not agree at all, *i.e.*, figures running up to 89 and 90. There are regularly butter shows held in a great many provinces of Germany, and in Mecklenburgh for the last three years, samples from those butters have been taken and analysed. In the autumn of every year a great number of the butters have been found with those low figures.

10929. We have been informed by the Dutch representatives, Dr. van der Zande and Dr. van Rijn, who have given evidence before this Committee, that the phenomenon to which you allude as occurring in East Friesland, takes place in Holland for about six weeks of the year, and that it is only during that portion of the year that these, which I may call, abnormally low Reichert-Wollny numbers, are obtained?—Those gentlemen would be referring to West Friesland, and as I have told you, we have found in East Friesland that in a great many cases the figure falls down in July to below 25.

10930. Is East Friesland German or Dutch territory?—It is German; it is in the north of Hanover; I have here some curves describing the butters from Hameln and other places in Germany, showing the Reichert-Wollny numbers in the various months of the year.

10931. According to those curves the lowest figure was arrived at between July and August in the year 1890?—Yes; that is with a butter taken at Hameln.

10932. Between July and August, the lowest Reichert-Wollny number was reached on that curve, and that was about 25·5?—Yes.

10933. Then in November the Reichert-Wollny number rose to as high as 30, or even 30·5?—Yes.

10934. The beasts then would be under cover, I presume?—They are always under cover.

10935. Throughout the year?—Yes, they are always housed. We have no meadows there, and there is not sufficient grass land to turn them out.

10936. In 1901 the curve is very similar in general character; that is to say it drops in August, when you get a number touching 25; then it goes steadily up till the middle of October, when it reaches 29; then there is a drop at the beginning of November, and a sudden rise towards the end of November, when it is 30·5?—Yes.

10937. Can you explain why these curves are so sinuous?—I think the explanation of that is that at that time, when we find the low Reichert-Wollny numbers, more cows are stale than at any other time of the year. They calve all through the year, but still there are always more calving in the early part of the winter.

10938. In that way the period of lactation would seem from these curves to have relatively considerable influence on the Reichert-Wollny numbers?—Yes, it has a very considerable influence.

10939. Would the feeding be the same throughout the year?—No; but then we have no evidence that difference of feeding makes a difference in the Reichert-Wollny numbers. There cannot be very much difference in the feeding, because they are housed all the year round.

10940. (*Mr. Gibbons.*) I suppose during the summer months they are fed on green food, although they are housed?—They get some green food, but only perhaps for the two months of June and July.

10941. But they give the highest figures when they are having dry food?—Yes; but I do not know that anything has been established about the influence of food on the Reichert-Wollny numbers.

10942. (*Professor Thorpe.*) Now, let us contrast those figures with the series of observations which you made in 1901 at Esens in East Friesland, is that remote from Hameln?—It would be about 200 kilometres, or 150 miles away.

10943. Why I put that question is because the character of the curve at Esens is so remarkably different from the Hameln curve; when you have a high Reichert-Wollny number at Hameln you have the lowest at Esens?—The keeping of the cows is totally different there.

10944. Will you kindly explain?—They graze the cows and put them in the stable as late as they can, because they cannot grow any food for them. They keep them out as long as they can, and turn them out as early as they can. They graze the cows from the beginning or the middle of May, until sometimes the middle of November. I should add that at Esens they let their cows calve at a certain time of the year, the early winter.

10945. This curve at Esens is very similar to that which we got from West Friesland through the Dutch chemists?—Yes, it is very much the same.

10946. And the conditions generally are what they are in Dutch Friesland?—Yes, very much the same.

10947. In Esens I find the Reichert-Wollny number mounts steadily up from January, when it is 26 to March and April, when it is at its maximum, about 30; that there it commences gradually to fall, and then it very suddenly falls during the late autumn until about October and November, when it is only 22?—That is right.

10948. During that period, as I understand, the beasts are grazing in the meadows, and at some time between October and November they are housed?—Yes, as a rule.

10949. Then between November and December practically they are all under cover, and the Reichert-Wollny number rapidly rises?—Yes; that is the time at which they calve.

10950. Is Georgsheil in a similar district?—That is also in East Friesland.

10951. The curve for that place is, with a little difference, very much the same?—Yes.

10952. What are Norden, Pewsum, Uttum, and Wittmund?—They are all small dairies, and all in the same district, namely, East Friesland. The curves there are very similar in character.

10953. In other words the conditions in East Friesland are very similar to what they are in Dutch Friesland?—Very similar.

10954. And your testimony in that respect is very similar to that which has been already brought to our notice by Dr. van der Zande and Dr. van Rijn?—I do not quite agree with Dr. van Rijn in this respect, that he attributes it chiefly to the housing of the cows. If that was so it would be quite reasonable to say that they should be housed a fortnight earlier, but in Mecklenburch they have found that the very low Reichert-Wollny figures occur early in September. I have other curves here showing that the lowest figures occurred in August, in 1899, in 1900, and in 1901. In such a case there can be no question of any inclemency of the weather, because in August and in September we have very good weather.

Prof. Dr. von Buchka and Prof. Dr. P. Vieth.

14 May 1902.

10955. (*Chairman.*) It has been pointed out to us by one witness that great heat has acted almost similarly to excessive cold; that is to say that any physical discomfort to the animal seems to reduce the Reichert-Wollny number?—That may be, but I do not think there is sufficient evidence to call it an established fact.

10956. (*Professor Thorpe.*) As the Chairman states, the evidence before us is that it is not necessary that the cow alone should be subjected to undue cold, and is thereby feeling miserable, but it is suggested that the cause is that she is not happy in consequence of the conditions; and any condition, whether it be hot or whether it be cold, even nervous excitement of that sort which affects her equanimity and makes her more or less disturbed and affected, will have its effect upon the volatile acids in the butter?—There is one thing which seems to point the other way. As I have already said, in East Friesland and in Mecklenburgh the cows are turned out sometimes very early in the year, because they really have not sufficient food to keep them over the winter; they are turned out as soon as they can be, and they are not taken in the stables at night, and therefore they sometimes suffer a great deal more in May than they do in October and November. Still one never finds any marked difference in the volatile acids when the cows are turned out from the stables early in the year.

10957. Do you mean that the volatile acids are not depressed, or that they are not increased?—There was no difference at all.

10958. (*Sir Charles Cameron.*) No difference under what circumstances?—When the cows are turned out from the stables to grass in the early spring, we certainly have sometimes rather inclement weather at nights, and still that does not seem to make any marked difference on the composition of the butter fat.

10959. (*Professor Thorpe.*) When they are turned out under the circumstances you have described, they are probably turned out at a time when they are very short of food, even in the stables?—But still it is a time when the fatty acids are rather high.

10960. (*Sir Charles Cameron.*) What is the physiological reason for depressing the amount of these particular fats in the butter?—We do not know; I wish we did, then we might provide against it.

10961. I suppose of all the fats that are depressed, the butyrin and these characteristic butter fats are depressed more than the other fats?—That seems so.

10962. Is there a general depression of the total fats?—No; on the contrary, as far as the stale cows are concerned we always find that with the low volatile acids the percentage of fat in the milk is higher.

10963. (*Professor Thorpe.*) The volume of milk is such that the relative proportion of fat is higher?—That is true.

10964. (*Sir Charles Cameron.*) But you do not know the reason why?—No, the cows will not tell us.

10965. (*Mr. Gibbons.*) When you made the two samples of butter in your own laboratory, and you found such differences in them, did you make them from the same cream or from different creams?—They were made from two different sorts of cream. One cream came from Horsham and the other from Glynde—both in Sussex.

10966. When you afterwards stated that you found no alteration in the acids, although the cows were kept very differently, what time did you allow to elapse between the alterations in the food of the cows?—I kept them for weeks and weeks.

10967. Fully sufficient for any alteration of food to produce its effect?—Yes.

10968. (*Chairman.*) You stated at the beginning of your evidence that you wished to say something in reference to what Dr. Gissel told us in Limerick?—Yes. He stated that the lowest limit was fixed in Germany at 21. That is not the case; there is no limit fixed in Germany for the volatile acids. He further said that in Germany butter fat with a lower Reichert-Wollny number than 28 did not occur. That is not the case. In the curves I have laid before the Committee I have given proof that there are many such butters in Germany.

Prof. Dr. von Buchka and Prof. Dr. P. Vieth.

14 May 1902.

10969. (*Professor Thorpe.*) What is your own opinion as to the desirability of fixing any limit of this kind?—I think it is most difficult, under the circumstances I have laid before you, to find a limit.

10970. (*Chairman.*) I believe Dr. Gissel recommended a limit of 23?—Yes, I believe he did.

10971. (*Professor Thorpe.*) In view of the general applicability and convenience of the Reichert-Wollny determination as a measure, or at all events an indication of the genuineness of butter, do you deprecate its continued adoption?—I think the Wollny process is the most convenient we have, and I believe that most of the butters which give a number below 25 or 24 should be looked on as very suspicious. It cannot, however, be taken as a proof that these butters are adulterated even if the Reichert-Wollny number falls below 24, because we know that we have every year hundreds of instances of butter which will be below that figure.

10972. This Committee has been appointed to "inquire and report as to what regulations, if any, may with advantage be made under Section 4 of the Sale of Food and Drugs Act, 1899, for determining what deficiency in any of the normal constituents of butter, or what addition of extraneous matter or proportion of water in any sample of butter shall, for the purpose of the Sale of Food and Drugs Acts, raise a presumption, until the contrary is proved, that the butter is not genuine." If I have followed you correctly, what you say is that it might be convenient, and would not be unjust to raise a presumption against the genuineness of butter if it showed a Reichert-Wollny number lower than 24?—Yes.

10973. You think this Committee would not be ill advised if they were to suggest that in all cases where butter fell below 24 in its Reichert-Wollny number, a presumption, at all events might be raised upon which there might be an inquiry how far it is a genuine butter?—Yes.

10974. (*Mr. Gilchrist.*) Would you not consider it hard upon the vendors of butter to be repeatedly brought to Court to prove the genuineness of their butter through the standard having been fixed at a certain figure—say the Reichert-Wollny number of 24?—It would be hard, of course; but still if we want to protect the public against sophistication something must be done in this way. I daresay it would be possible to provide against any inconveniences which might arise where a man says, "I have here a butter which comes from a district where at this time of the year you might expect low figures."

10975. (*Professor Thorpe.*) That would be a sufficient defence, would it not?—It would be, so to speak, a certificate of origin, and the analyst would know at once that he must be careful then in drawing his conclusions.

10976. In other words, it would mean this, that if the analyst at a certain period of the year got a butter with a Reichert-Wollny number of 24, or even perhaps a little lower, he would know that in all probability this butter had been affected by those considerations that you have laid before us, and naturally he would give that butter the benefit of the doubt?—He would take those things into consideration. I believe that is quite a workable method. The butter merchant has always a means of finding out where his butter came from.

10977. The analyst might suppose that a particular butter that was referred to him was Colonial butter, or Argentine butter, or butter coming from a locality which was not liable to be affected by the considerations you have indicated. Very well; he would send in his certificate, and then it would be a matter for the persons impugned to bring forward any such rebutting evidence as they could. Naturally they would go to the importer of the butter and say, "Where does this butter come from?" and he would say it came from Mecklenburgh, or it came from Sweden, and so forth, and that would be a valid defence, would it not?—Yes.

10978. (*Sir Charles Cameron.*) Would you not rather adopt some figure that you could accept as unequivocally showing that the butter was not genuine?—I think our knowledge does not go far enough to enable us to fix the lowest limit.

10979. What about 21?—I have never found a butter in the market which comes down below 21. I do not think there would be any great harm in such a figure, but still some at lower figures might turn out to be genuine butters—we do not know.

10980. What if you went down to 20?—I believe 20 would be as low as anyone can desire.

10981. (*Professor Thorpe.*) Is not the position in regard to butter exactly similar to the case of milk?—Yes.

10982. Of course, now and again a sample of milk does contain less than 3 per cent. of fat, but, nevertheless, the Board of Agriculture has fixed 3 per cent. of fat as the point at which the presumption should be raised. You tell us that although there may be butters now and again falling below 24, nevertheless 24 is a number at which the presumption might legitimately and properly be raised?—Yes.

10983. (*Sir Charles Cameron.*) If you got only 1·5 per cent. of fat in milk you surely would not say that there could be any presumption at all raised except one way?—I could not, except that was milk coming from a single cow. The milk of a single cow might show a much lower percentage of fat.

10984. Lower even than 1·5 per cent.?—Yes. It happens sometimes that the fat falls down very low. If the cow is in heat it sometimes comes down below a half per cent.

10985. The cow's full yield, milk strippings and all, only has half per cent. of fat?—Less than that.

10986. I should like to see that cow?—It is possible that a cow which gives regularly milk with 3·5 per cent. of fat may, without being ill, but simply because she is in heat, give a milk which contains less than half per cent. of fat; indeed one case has been proved in which the milk contained not more than 0·17.

10987. (*Professor Thorpe.*) There was a large body of evidence brought to the knowledge of the Committee which dealt with the milk standards, that, for example, milk taken from even prize milkers at shows, would contain these abnormal amounts of fat. When a cow is placed under abnormal conditions, and especially when she is in a condition of, it might be, sexual excitement, down goes the fat in an extraordinary manner; is that not so?—Yes.

10988. (*Sir Charles Cameron.*) Then why not employ a standard that there could be no question about?—I do not know where to fix the lowest limit; I do not think it advisable. As soon as the figure comes down very low—say below 24 or 23—I think proof must be given that the butter is genuine.

10989. You could not have a butter without any volatile fatty acids unless it was a butter like suet or lard?—No.

10990. Surely there must be some standard, then, that can be fixed—a minimal one at all events?—I have no reason for thinking that 20 should not be fixed as the lowest limit, because I quite believe that, as a rule, it will never fall below that; but, on the other hand, I do not see why that should be fixed, because there are so many doubtful cases where the Reichert-Wollny figure will be between 23 and 24, and I think it ought to be proved in those cases whether the butter is genuine or not. I do not see the use of fixing a minimal limit.

10991. (*Professor Thorpe.*) I do not know whether you are competent, or whether Dr. von Buchka would take upon himself to answer this question: A suggestion has been more than once thrown out to this Committee that it would be a wise thing on the part of all butter-exporting countries that they should submit themselves to some kind of internal control over their exported produce, very much in the same way that it is done with great success in Denmark. Could one of you gentlemen say how far your own authorities would favourably entertain such an idea?—(*Dr. von Buchka.*)—This point has not yet been considered by the German Government, and we did not know until this moment that such a suggestion would be made. I am sure, as far as I know the intentions of the German Government, that they would be very glad to co-operate in such an international arrangement. I think if this were suggested to the German Government they would be very ready to fall in with it.

10992. Are you aware that this question of international co-operation was raised at a recent Conference in Brussels?—I did not know that.

TWENTY-FIRST DAY.

MEETING HELD AT BURLINGTON HOUSE, PICCADILLY, W.

Thursday, 15*th May*, 1902.

PRESENT :

The Right Hon. HORACE CURZON PLUNKETT (*Chairman*)

Sir CHARLES A. CAMERON, C.B., M.D.
Professor T. E. THORPE, C.B., LL.D., F.R.S.
Major P. G. CRAIGIE.
Mr. CHRISTOPHER DUNN, J.P.
Mr. GEORGE GIBBONS.
Mr. JOHN GILCHRIST.
Mr. PATRICK HICKEY.
Professor J. M. THOMSON, LL.D., F.R.S.

Mr. A. E. BALLEINE, *Secretary*.

Mr. WILLIAM FREDERICK KEATING STOCK, F.I.C., called ; and Examined.

Mr. W. F. K. Stock.

15 May 1902.

10993. (*Chairman.*) You are Public Analyst for the county of Durham, and for the borough of West Hartlepool?—Yes.

10994. How long have you occupied that position?—I have been Public Analyst for the county of Durham for 22 years, and for the borough of West Hartlepool for 15 years, I believe.

10995. Have you had much work in connection with prosecutions under the Sale of Food and Drugs and Margarine Acts?—We have had a number of prosecutions, but I have been fortunate in this respect, that we have not frequently had to deal with small additions; that is to say, when a butter has been adulterated we have generally found it has been purely margarine, and not simply a case of a small addition of foreign fat.

10996. I may inform you that the Committee have already reported as to the percentage of water in butter, and a Regulation dealing with that branch of our enquiry comes into force to-day. So I will merely ask you upon that whether you generally agree with the recommendation of the Committee?—I quite agree with it, and recommended that limit to my own County Council before this Committee announced that decision

10997. Do you think the procedure under the Acts will be greatly facilitated by the making of the Regulation?—I think so, but in my experience I have only touched 16 per cent. of water on two occasions.

10998. What have you to say about the addition of extraneous matter other than water?—Do you put the question as including salt?

10999. Yes, you may deal with the addition of salt now?—In 22 years' experience I have never met with a quantity of salt up to 10 per cent.; but I have on two occasions found 9 per cent., and on one occasion 6 per cent. If I might make a suggestion, seeing that you have allowed the addition of a small proportion of borax or boric acid, I think 5 per cent. of salt is a quite legitimate amount, and ought not to be passed.

11000. (*Professor Thorpe.*) Pardon me, we have not allowed the addition of boric acid?—I meant to say that the Board of Agriculture has done so.

11001. That is not even the fact. The exact state of the matter is that the Committee on Preservatives in Food has reported, and has suggested that a maximum of ½ per cent. might be permissible; but that is not law?—I am glad to hear that.

11002. No Regulation has been issued on the subject, and therefore it is quite open to magistrates or to anybody to be still of opinion that it is undesirable that boric acid should be used?—That is not understood generally. I believe it is understood generally that you have allowed, and will permit, the addition of ½ per cent. of boric acid.

11003. (*Chairman.*) This Committee has suffered a great deal from public impressions, and I am afraid that the general understanding in these matters is not in accordance with the facts?—I am sure it is not.

11004. What have you to say about the question of the deficiency in any of the normal constituents of butter?—If that is to be looked upon in respect to adulteration, it simply means that something has been added which has diluted the normal constituents of butter; therefore you would have to look upon that as a matter of addition, largely because a natural butter, in my experience, would not be deficient in normal constituents to any large extent.

11005. Do you know of cases where honest butter, as we call it, has been so exceptionally deficient in normal constituents, especially in volatile fatty acids, that it might be mistaken by an analyst for adulterated butter?—I have just explained to the Committee that my experience has been a fortunate one, and that I have only had to deal with large additions of foreign fat. The experience of other analysts has been somewhat different. Dealing with your question now, I might be allowed to take results which have been arrived at, perhaps, by other analysts. I do not vouch for them, but I believe they are correct. I find that butters from the various countries differ very considerably, and I would explain the difficulties of the public analyst in this respect, so as to clear the ground for answers which will come from me later. When the public analyst goes before a bench of magistrates, he is not dealing with people who are technically expert, and he has to take his sample just as it comes to him; it bears a number, and no name whatever. He probably makes a correct analysis—most public analysts do, I believe, nowadays—and he states his opinion on that analysis. If that opinion is adverse to the sample, he is examined. If the case is defended, a solicitor promptly says, "Now, you have given us your analysis; what did you take this butter to be? Did you think it was English, or did you know that it was Siberian butter?" The analyst knows nothing about it, and he is promptly at a discount. He could not say what the butter was, therefore he can only take his analysis and compare it with what he knows himself. He is in a difficulty at once, because butter does naturally vary in composition, and you will get figures like those which have just been obtained by van Rijn. I believe Professor Thorpe has been good enough to allow that gentleman or his representatives to enter the Government Laboratory and to make analyses according to the methods in use in that laboratory. So I think we may take those analyses to be correct. Van Rijn has published recently the analyses of 352 samples of Dutch butter to which he has applied various tests—some physical and some chemical. Take the physical tests first. On the refractometer he finds the lowest deviation 38·9 degrees, and the highest 45·5. Then he takes the volatile acids by the Reichert-Wollny method and he finds the lowest number (we may call it the lowest number so that it does not become too technical) 19, and the highest 32. Then he takes the insoluble fatty acids, and he finds the lowest 87·6, and the highest 91; but he only gets one specimen, I am glad to say, out of the 352 which touches 91 of insoluble fatty acids. Then, taking the soluble fatty, his lowest goes down to 3·8, and his highest rises to 6·2. Taking the saponification value, his lowest figure is 209, and his highest is 229. The lowest figure for the iodine absorption is 30·6, and the highest 49·1.

11006. You have pointed out in the *précis* of your evidence that an analyst is at a disadvantage because he does not know the history of the particular sample. We have heard a great deal of evidence about the human equation, and I have gained the impression that

Mr. W. F. K. Stock.

—

15 May 1902.

it is rather a danger than otherwise in analytical proceedings. Do you not think that the danger would be rather accentuated by a knowledge of the history of the sample of butter?—I quite agree with you; but I have a suggestion to make to the Committee, if I may be permitted later, which, I think, deals with this particular point.

11007. Perhaps you will deal with that point now?—The idea occurred to me owing to the fact that I have been met with difficulties of this kind in other matters, through not knowing the origin of my sample. In order to meet this difficulty I would suggest that, first of all, each parcel of foreign butter should be marked with the name of the country from which it was exported.

11008. Before it is given to the analyst?—Before it comes on to the market. That is done with margarine. Secondly, I would suggest that the article should bear this mark when exposed for retail sale; and, thirdly, I would suggest that the analyst, having made his analysis without any knowledge of the origin of his sample, should give his certificate in the usual way. If he certified to a small percentage of foreign fat (there is no difficulty about large percentages), deducing his opinion from average results, then the name of the country from which the sample was imported should be communicated to him by the inspector, who would naturally know it, having bought the sample; and if this necessitated a change in the analyst's opinion, it could be made. That is the suggestion I have to make to the Committee. Of course, there would be difficulties in carrying it out; there always are difficulties in matters of this kind.

11009-10. Would you leave it to each analyst's judgment as to how much allowance should be made for the circumstances of the different countries from which the butters might come?—Yes; we a have a very considerable amount of evidence now on this point. We have the records for German, Swedish, Italian, American, Swiss, French, Holstein, and Austrian butters, which have been determined by a large number of analysts and over a large number of samples. In a very short time, seeing that the analyst would get to know the origin of his suspicious samples, we should rapidly accumulate a large amount of information which would then put us in a much better position than we occupy now.

11011. You have made some suggestions to the Committee with, I understand, a double object. Firstly, you want to give more information to the purchaser in order that what is called technically "sufficient disclosure" may be really adequate for his protection; and, secondly, you want to give the analyst knowledge of certain facts which might modify his opinion as to the genuineness of the butter?—Yes. I would not allow the analyst to have that knowledge until he had made his analysis—I want that analysis to be absolutely unbiassed in any way; then the inspector could communicate to the analyst the name of the country from which the butter originated, and he would be able to overhaul his results once more and see whether what he had found in his analysis came within the limits of genuine butter coming from that country.

11012. I presume you would agree with the Committee that it is exceedingly desirable that the procedure in these matters should be made as uniform as possible?—Yes.

11013. Are you not introducing a very big human equation again in allowing the analyst to alter his judgment, as seems good to him, according to the estimate which he may place upon the difficulties of the various countries from which the butter may come?—I hardly think that. If I might draw a parallel from another kind of analysis, I would point out to you that in milk analysis if the analyst found that his fat fell down to say 2·75, and his limit was 3 per cent., and he got to know when he issued his certificate that the sample was from one particular cow and not from a mixed herd, he would say, This thing might happen, and therefore I have no right to say that the sample has been adulterated or has been deprived of its fat. He would be in just the same position with regard to butter, if, when he had made his analysis, he got to know that it was, say, a Russian butter or a Siberian butter, and if he knew from his own observation or from knowledge that he had acquired from other sources that the analysis that he had made brought the sample within the limits known in Siberia or in Russia, then he would say, "I cannot declare that this butter is adulterated, because I have got a figure which comes above the lowest limit for that country."

11014. Probably this allowance would have to be made in somewhat rare cases?—That is so; the cases would be rare, and that is why I think one should take notice of that particular thing. I am quite sure the Committee would not like to run any chance even of there being injustice done. If only one sample out of 350 fell below the limit, I should be rather inclined to think that the analyst might have made a mistake in that particular analysis. I do not think one sample would justify one in saying that every butter which fell under that limit was not adulterated. .

11015. You do not quite apprehend my meaning; what I meant was that the exceptions which you wished to make for butters produced in certain countries would probably be few?—They would be few, I have no doubt.

11016. Would it not, therefore, tend to uniformity of action if, in whatever Regulation may be made by the Departments, these exceptions were specifically set out for the guidance of analysts generally?—Yes, that would be a very good way indeed to take it.

11017. Would not that be a better way than your proposal that each analyst should make what allowance he himself considers ought to be made in respect of the particular countries of origin?—I am afraid I have not made my meaning quite clear. My point was this: We have knowledge which gives us the lowest and the highest limits for butter in certain countries; if the analyst found that his sample dropped below English butters, and he knew that it was an English butter he was dealing with, then he would have good ground for saying the sample was not genuine, but if it was a Swedish butter, and his analysis did not fall below the limits for Swedish butter, he would say, "This is genuine Swedish butter, because my analysis comes higher than my lowest limit for Swedish butter"—if he knew that, but he never does know the origin of his butter. The analyst, therefore, is tied to take certain figures that either he or somebody else has worked out for butter, taking butter as a whole, and not as an article of differing origin, or taking, say, English butters, if he is dealing with nothing else. The whole value of his evidence is sometimes destroyed because he does not know the origin of the samples.

11018. With regard to the figures you have just given us from Dr. van Rijn's analysis, I presume that the butters he analysed were all known to be pure?—He vouches for the purity of the samples.

11019. What tests do you yourself mainly rely upon?—Within the last year I have made analyses of 105 samples of butter in the county of Durham, and a number from West Hartlepool, which I have not included in the table I have before me. West Hartlepool is one of our shipping ports, and a great deal of butter comes in there, and I considered that these 105 samples would cover those deliveries. I found that the volatile acids ascertained by distillation, *i.e.*, by what is known as the Reichert, or Reichert-Meissl, or Reichert-Wollny method, gave as their lowest number 21, and, as their highest, 32.

11020. Are the Reichert-Meissl and the Reichert-Wollny figures identical?—They are practically identical; that is, they are two means of arriving at the same thing.

11021. Do those two different means arrive at exactly the same results?—Yes, within very narrow limits, at all events; they are comparable amongst themselves.

11022. Is that the test upon which you mainly rely?—That is one of the tests; I am coming to the others. The first thing I do is to take the saponification value, that is to say, I find how much potash 100 parts of fat will consume in order to convert it into soap. I have got for my lowest figure over these 105 samples 21·6 per cent., or 216 as the saponification value, and for my highest 32·5 per cent., or 235 as the saponification value. Then I take, in a questionable case, the insoluble fatty acids and the Reichert-Meissl figure, or the Reichert figure alone, just as is most convenient—one does not tie one's self to either. For the Reichert-Meissl I have got as my lowest number 21, and as the highest 32, as I have told you. For the insoluble fatty acids (that is the Hehner test) I have gone down to 86·5 and up to 90·07. In that case, which gave 21·6 by the saponification test, which was distinctly low, I determined the soluble fats, which is another test, and I got 3·9 per cent., which was just a tenth higher than van Rijn makes it for his lowest genuine sample. I was obliged to consider that that was a genuine butter, because I did not know its origin.

11023. Do you consider that there ought to be an official test?—I should like it exceedingly, because that would clear away an enormous difficulty. I do not want to be tedious, but I should like to explain this to the Committee. One appears on a case to give evidence for the prosecution, but not as an advocate, and one is promptly met by some other analyst who has got his own method of analysis, and who has given his figures to the solicitor for the defence. Those figures are made the most ruthless use of. As a consequence, if the Public Analyst, who has made his analysis for the prosecution, cannot say absolutely that he knows the origin of the butter, or that he knows what the figure for that butter ought to be, then the figures from the other side simply lead to a failure of the prosecution. If you had a standard, every analyst would be tied to make his analysis by this one method. The standard is working admirably with regard to the analysis of milk, and, in regard to butter, the magistrates would have no option but to take the standard method which had been adopted by this Committee.

11024. We have had expert evidence to the effect that the Reichert-Wollny or Reichert-Meissl number is, on the whole, the most satisfactory test upon which to rely; and that all the other physical and chemical tests are useful in the laboratory either for the purpose of making out a *primâ facie* case, or for weeding out samples, or for corroborating the Reichert-Wollny number, but still that the Reichert-Wollny number is on the whole the best test to be adopted if it is determined that there shall be an official test. What is your view upon that?—I should like it better if the limits were not so enormously wide. You have 19 as the lowest figure for genuine butter (if you take Van Rijn as being authentic, and if you regard his Dutch butters as coming on to our market), and you have a highest of 32·1.

11025. I am not asking you at the moment where you think the limit should be placed, but whether you think that whatever standard is fixed, it had better be fixed on a certain Reichert-Wollny number?—Yes, I think it should, but I should supplement it by what is known as the Hehner number, that is, by the determination of the fixed fatty acids; I look upon that as a most valuable method.

11026. You would have a composite standard then, consisting of the Reichert-Wollny number and of the Hehner number?—I think so; I should much prefer that myself.

11027. Can you tell us concisely what would be the relative importance of these two numbers, and what their relation to each other would be?—Their relation is almost practically direct. If you have high insoluble acids, then you have low soluble acids, and that means that you would have a low Reichert-Wollny or Reichert-Meissl number; and conversely, if you have a high Reichert-Wollny number, you would have a low Hehner number.

11028. Supposing that the two tests produced different results, would you, as we should do in Ireland, divide the difference—that is, would you take the mean between the two, or would you attach more importance to the one than to the other?—I think one would corroborate the other.

11029. Have you such reliance on the two that if there was a discrepancy you would consider that undoubtedly there was a fault in the analysis?—I think so; certainly one would corroborate the other, and if you had a high Hehner figure you would necessarily have a low Reichert-Wollny figure. The only difficulty would be to fix what the figures should be.

11030. Upon that have you come to any decision in your own mind?—Yes. It is difficult to commit oneself to a definite statement on this head, but I think that when you get down to 21 for the lowest Reichert-Meissl, you are getting very low indeed, and when you get over 90 for the highest Hehner you are getting very high, and there is reason to suppose that there is something wrong with the sample. That is just why one does not feel that one should be quite tied to two tests only. Still, in order to narrow it down and to make it uniform, if two tests were to be selected, I would certainly take those two, and I would say that when you get down to 11 for the Reichert, or 22 for the Reichert-Wollny, you have got quite low enough. I would make 11 the limit for the Reichert test.

Mr W. F. K. Stock.

15 May 1902.

11031. I presume you are aware that a Reichert-Wollny number of 35, although rare, is not unknown?—It has been reached, I know.

11032. And you are aware also that a number of 30 is not at all uncommon?—That is a very common figure indeed.

11033. Would it not be a profitable industry to take butter with a Reichert-Wollny number of 30 and adulterate it down to such a number as 22?—Whatever limit you fix, you will always be open to that.

11034. We are aware of that, but still it is a question of degree. It is clear that the lower the official number the more temptation there will be to inexpert adulterators to join the more expert and defraud the public?—That is so. I do not know whether it would be profitable to put so small a proportion as 10 per cent. of foreign fat into butter—and when you get outside the limit of 10 per cent. you are getting very good ground for supposing the butter is not genuine. Taking the whole of the tests together, you are sure to find a discrepancy in some one particular test which will tell you that your butter is not what it ought to be.

11035. You are aware, of course, that wherever the figure (or figures, if you take two tests) were placed, the effect of the official standard would only be to create a presumption?—Yes, that is so.

11036. And therefore that a very good defence could be set up?—Yes.

11037. With that in view, do you still think that so low a number should be selected that it is almost certain that any butter with a lower number would be fraudulent?—Yes, I would take it in that way, only I would protect myself by the suggestion that I gave you with regard to the origin of the sample. If that could be adopted, I certainly would, for a time at all events, take 22 as the lowest limit for the Reichert-Meissl or Reichert-Wollny.

11038. If 22 were selected, and if butter had obviously been fraudulently manipulated, do you think that any Court would convict in the case of a butter with a Reichert-Wollny number of 23, say?—If you could show that the country from which that butter issued gave a higher number, I think there would be very good grounds for convicting. That was my point.

11039. You might have good grounds for it, but in practice, after that limit were fixed, would you ever get a Court to convict where a butter had a higher Reichert-Wollny figure than the prescribed number?—Yes, if your standard carried the qualification that I suggest, it would be known to the Court.

11040. You would admit that you are rather complicating the calculation which laymen, as well as experts, have to enter into in administering these Acts?—Quite so; I know it is a complication, but one must endure these complications to get out of the difficulty.

11041. You think the difficulty must be faced in the public interest?—I think so. There is one other point upon which, however, you may have had evidence—that is, the introduction of cocoanut oil into butter. That complicates things immensely, because you have an oil there with a considerable proportion of volatile fatty acids, and a correspondingly lower proportion of fixed fatty acids. By introducing this fat you may get a mixture of three fats—butter, lard oil, say, and cocoanut oil—which will give you a very excellent analysis, and be altogether factitious. I do not know that anyone has dealt with that in any sort of way.

11042. (*Professor Thorpe.*) That matter has already been brought before us, and several suggestions have been made as to how the presence of cocoanut oil could be detected with a fair amount of certainty. By the consideration of a number of collateral tests it is quite possible to draw a fair inference as to whether the butter is factitious or not, although, on *primâ facie* analysis, it might give numbers which seem to be all right. You will see, when the evidence is printed, that that has been exhaustively dealt with?—Still, dealing with that subject, I should like you to see these photographs, which, I think, are very interesting. They are micro-photographs—rather rough, I am afraid—of genuine butter, and of butter containing 10 per cent. of cocoanut oil; I have given the proportion at the bottom. Those fatty acids were crystallised from chloroform. I might say to you—it is not a breach of confidence—that, some few years ago now, Mr. Allen

Mr. W. F. K. Stock.

15 May 1902.

the West Riding analyst, sent to me two samples of butter, and asked me if I could tell him which of those contained cocoanut oil. In three-quarters of an hour I could tell him that one contained cocoanut oil, and I sent him those photographs on the same day that I received the samples. I have tried some hundreds of microscopic slides prepared in the same way, and I never found the test to fail. Cocoanut oil always feathers out in that special way; if there is even 5 per cent. there, I think you can find it out.

11043. These photographs are very interesting. I suppose that the problem with which we have to deal is very similar in principle to the problem before the other Committee, to which you made reference, the Milk Committee?—Yes.

11044. That is to say, that Committee had to determine at what point, in fact, a presumption as to the genuineness of milk should be raised in the terms of Section 4 of the Act of 1899, and, as you say, the problem with which we have to deal is very similar in principle?—Yes.

11045. In the case of milk we were made aware that it was a fluid subject to very considerable natural variations; we were told that its composition was affected by all sorts of conditions, such as the particular time of milking, breed, feeding, and what not; therefore the Committee had to come to a conclusion as to what particular limit of fat and what particular amount of non-fatty solids should be laid down if a Regulation was made upon which the presumption might be raised. That was the condition there, was it not?—Yes.

11046. You have made us aware, as of course other witnesses have made us aware, that butter itself, although a manufactured product, is nevertheless liable to very considerable variations in character. Of course before we make a suggestion to the Board of Agriculture what we have to do is practically to learn, as in the case of milk, where the line, so to say, can be drawn; is that not so?—Yes.

11047. You are of opinion, apparently, that the special character of butter is very largely affected by its place of origin?—I gather that from reading. As I have told you, as a public analyst I know nothing of the origin of my samples, and therefore I can only take the results got by other people; but I think one may accept them as being correct. I find in that way that it is the case that butter is largely affected by the place of origin. A number of instances of Italian butters has been given, and I find that in an acknowledgedly genuine sample the lowest Reichert-Wollny number was 20·63, and that the highest Reichert-Wollny number in those Italian butters was 31·4. I do not know whether we get any Italian butter into England or not, but if we do, and if we take 11 for the Reichert test, or 22 for the Reichert-Wollny test, we should clearly shut out that butter which showed 20·63.

11048. I think you rather misunderstood me. Do you believe that, so far as regards the volatile acids, the butter of a particular country has a special character?—As giving a lower proportion than butter of other countries?

11049. Yes?—It appears from what I see and the results I have quoted that it is so.

11050. All the evidence that we have up to now accumulated goes to show that English or Irish made butter is just as liable to those wide variations in the Reichert-Wollny number as even Danish or Friesland butter, or any other butter you like to name?—I quite agree. I have not left English butter out of my calculations. I say that the analyst should know whether it was an English butter. I am not simply trying to put the fault on foreign butters, as I know that English butters vary.

11051. What I want to be quite at one about, if we can be, is this—no butter is more subject to wide variations in character than any other butter?—That is hardly supported by what I have read. I think that my own samples would probably be largely English butter; of course I am not clear about that, as I should get foreign samples amongst them; but I may tell you shortly that 88 per cent. of my samples drop well within the limits for what is known as genuine average butter.

11052. And so would 88 per cent. of any butter from any other part of the world—there is no question about that?—Then you would have the other 12 per cent. outside.

11053. We had the pleasure of examining Dr. van Rijn and Dr. van der Zande, and they gave us *in extenso* the information which you have very briefly indicated, which, no doubt, has been brought to your knowledge by the book of Dr. van Rijn, which was very widely circulated?—That is so.

11054. We know from him precisely what proportion of the butters of Friesland are of what you might call this abnormal character, at what time of the year, and to what extent, they occur. What Dr. van Rijn pointed out to us occurred in Friesland, Dr. Vieth said occurred very much at the same period of the year in North Germany. We know that it also can occur in Ireland. In fact, it can occur everywhere, apparently, so far as our information goes, where the cows are subject to the same treatment and the same climatic conditions as they are in Friesland?—I quite agree.

11055. I am coming round to this point. There does not seem to be any absolute necessity to ear-mark the butter or to connect it up with its country of origin when any butter, no matter what its country of origin may be, is liable to show the same variation, or the same character of variation; I do not, therefore, see how the analyst is very particularly advantaged by knowing what the country of origin is?—I quite see your point. If you fix your limit low enough, the suggestion I have made of course will be cut out altogether, as it will be of no value.

11056. Whatever limit was fixed, those considerations which you have adduced, namely, that you must know the country of origin, do not seem to me, if I may say so, to have very much relevancy?—Only I find that in the case of Italian butter we get samples falling much below the figures for English butter, so far as I am able to make out. I have collated some thousands of samples from various sources, and I have not found a genuine English butter dropping down to 20·63.

11057. I think we shall be able to show you that that does occur. The Committee had certain facts placed before them yesterday which showed that there are times when Irish butter will drop down as low as 20·6 Reichert-Wollny. Broadly speaking, what I want to make quite clear to you is that, on the whole, the country of origin does not tend to affect the particular value, and that all butters, no matter what their country of origin, will show very similar variations. Of course I do not say that the butters from all countries are identical in commercial character—that would be absurd, because they are not. Apart from the mere analytical and approximate composition of the butter, those other factors are, and notoriously are, very different in different butters. What I want to make quite clear—at least, where I hope you will agree with me—is that there is no special necessity, from the point of view of the analyst, to know what the country of origin is?—I have not had the pleasure of reading the evidence that you have got recently, and therefore I must take what figures I can get, and I have stated the idea that occurred to me from reading the figures I had before me. I found in some cases butter fell lower than I had ever known it fall before, and I wondered how that particular kind of butter was to be dealt with. It seemed to me, under the circumstances which were then before me, that it could only be dealt with by the analyst knowing the origin of that butter. Now you tell me that it has been shown to you that English butter or Irish butter will go quite as low as that, and therefore my suggestion rather falls to the ground.

11058. I will even supplement what I said: you have no doubt followed with some interest the Siberian butter question?—Yes, I have.

11058*. Perhaps you have gleaned the impression which a great many persons have, that Siberian butter is characterised by a very low Reichert-Wollny number, a very high percentage of insoluble fatty acids, and a relatively low percentage of soluble fatty acids?—Yes.

11059. The Committee is now informed by a large number of analyses which have been made for them that even in that respect Siberian butter is not different from Argentine butter, or Colonial butter, or any other butter you may like to name. Now and again, it is true, there do occur circumstances where Siberian butter may have a low Reichert-Wollny number; but, on the other hand, the number of such occurrences in Siberian butter is not greater than may occur in Friesland butter, or Norwegian butter, or any other butter?—Of course, that being the case, my suggestion somewhat falls to the ground; but at the same time you are left in this position, that if you fix a low number you then open the way for a considerable addition of foreign fat over and above what you would allow if you had a higher number.

11060. I quite concur. Of course that, we are all well aware, is the difficulty we have to face, but there again I remind you that our problem is precisely similar to that which the other Committee had in the case of milk?—Quite so.

11061. A 3 per cent. limit of fat does not represent the average composition of milk which is given by cows in this country, does it?—It is much too low for the county of Durham, I can assure you.

11062. Taking the whole country it is distinctly low. When the Committee suggested a standard of 3·25 (which was actually the figure suggested by the Committee) we knew even then that that would allow the addition of a certain quantity of separated milk. That was the difficulty we had to face. Here again any reasonable Reichert-Wollny number that we should agree upon would of course allow of the addition of a certain quantity in certain cases of foreign fat. That is a danger which in any case we shall have to run. The point we wish to arrive at is, if we agree to fix upon a limit, what is a fair and reasonable limit at which to fix the Reichert-Wollny number—exactly as in the case of milk, we had to ascertain was was under the known circumstances—the ascertained conditions—a fair and reasonable amount of fat to fix?—Yes.

11063. What I should like to get from you, with all the information you have before you, having some regard to the frequency of the occurrence of these relatively low Reichert-Wollny numbers which you speak of, is what would be a reasonable limit at which to fix the Reichert-Wollny number. I suppose you will agree that there is no necessity, especially under the terms of the statute, to include every butter, however low its Reichert-Wollny number may be?—No.

11064. Any more than there is any necessity to include any sample of milk, however low the amount of fat in it may be?—No.

11065. We must draw the line at a reasonable point, so as not to frequently hit the innocent man. That we may occasionally hit him we must admit is the case, and of course the public interest steps in there. A man has no moral right to systematically vend a milk containing 2·7 of fat, and all that sort of thing; he ought to amend his procedure or to change his cows—I suppose you will allow that?—That is my argument always in a case of that kind. I will answer your question directly, and say that I would take 22 for the Reichert-Wollny number as the lowest point. That is my judgment, based on my own experience over some hundreds of samples. I very seldom drop down to anything like 10·5 Reichert.

11066. Why, may I ask, should you go so low as 22 when you told the Chairman that the average was something approximating to 30?—That was the highest—not the average. My lowest was 21, and my highest 32.

11067. How many times did you get that low number?—Not very often—it must have been one of the 12 per cent. which came outside my 88 per cent.

11068. In what average number of instances did you get down to as low as 21?—I do not think I got down to as low as 21 in four cases out of 105 samples.

11069. In view of that fact, do you think you are justified in putting up a limit of 22 when you have only four cases out of 105 samples—which is less than 4 per cent.—as low as 21? Why should you fix the presumptive limit at which trouble begins at one point higher?—I am only following your example in regard to the cream in milk.

11070. Of course you are in principle; but are you actually in effect?—I am by putting it low.

11071. Are you not putting it relatively much lower than we did in the case of milk?—I do not think so.

11072. Do you not think it is a wider departure from the average of, we will say, 28 or 29, to drop down to 22, than was the case with milk where a standard of 3 per cent. has actually been adopted, though the average there was 3·3?—No. If I took your 3·3 as actually above the average, I should say that was going outside it; but that is by no means my average, and I am only judging by my own figures. I very often get 4·5 per cent. of fat in a sample of milk, and my average is higher than what appears to be the case for the whole country. To come back to the Reichert-Wollny figure; it is only with a desire not to do any injustice that I put it so low as I have suggested, because one does get butters which fall as low as that occasionally, and when one comes to examine them further, one sees that they are normal and genuine butters. It seems rather hard to put down even four genuine samples out of 105 as adulterated.

11073. May I recall you to the actual position of matters? Your statutory position is this—that you are an executive officer, who merely raises the presumption in the public interest, that a certain article which is vended is not of the character that it ought to be?—That is so.

11074. You do not regard your certificate as absolute—as practically passing a final judgment upon the butter, do you?—No, there is an authority above me.

11075. What you do is to raise a *prima facie* case against the butter, and that is all?—Yes.

11076. That is provided for in the statute?—Yes

11077. It must, I suppose, go without saying that in probably 99 cases out of 100, when you have brought a case into Court of a butter with a Reichert-Wollny number as low as 21 or 22, that butter was *ipso facto* wrong?—I think that would be so—it would raise a presumption, undoubtedly.

11078. Would it not be the fact that it was wrong in every case that your presumption could not be rebutted, and that you succeeded in establishing a conviction? If it turned out that this was a low class Friesland butter, or a low class Italian butter, where we know the Reichert figure has dropped very low, where would you be then?

11079. Of course, the presumption would be rebutted?—Yes. Taking that view of it I should be quite willing to go higher. I think I ought certainly to defer to the large amount of evidence that you have recently had. I was simply putting my figure as a matter of judgment, based on my own experience—that was all. The lowest genuine butter I have came across I put at 21 R.W.; and I should say that that was a very rare occurrence indeed. I should distinctly prefer to raise the limit, if it could be fairly done.

11080. (*Sir Charles Cameron.*) Were you quite certain of the genuineness of that butter?—I think there is no doubt whatever about it.

11081. (*Professor Thorpe.*) Although I rather seemed to indicate that you did not get very much advantage from knowing the country of origin, still I am quite with you up to a certain point, that there are occasions on which it might be of use to you in forming a judgment if you knew the country of origin. Supposing now you did know that you had a Friesland butter, and that you got it in the month of May, and that the Reichert-Wollny number was 21, then what would be your inference?—I am afraid I should want to know in what month this butter was made. I should be in a difficulty once more, undoubtedly.

11082. If you knew anything of the conditions upon which the Dutch trade is carried on, you would know very well how old that butter was?—I am afraid I do not know—that is just my point—we do not know the origin of our samples.

11083. I say that if you knew anything of the conditions under which the trade is conducted, and if you had a sample of Friesland butter in the month of May, giving a Reichert-Wollny number of 21, I should have no doubt whatever what your judgment would be?—I do not want to put the limit down at all. Of course, you can judge for yourselves. I simply put that limit as being what I have experienced myself as the lowest point to which I have ever known a genuine butter fall. One is led by a desire not to do injustice to any sample of butter if it is really genuine.

11084. I understand the kind of qualification which you yourself attach to your suggested limit of 22. You have read Dr. van Rijn's book, have you not?—Yes, I have.

11085. Do you know what proportion of the Friesland butter he shows as having such numbers as 21 or 22?—It was a very small proportion. Out of the 352 samples, I think he only got one that dropped as low as 19.

11086. (*Sir Charles Cameron.*) How many did he get below 24?—I have not had the opportunity of running those figures out; but I should say there were very few below 22.

11087. (*Professor Thorpe.*) Will you take it from me that not 3 per cent. of Dutch butters are below 25?—I

Mr. W. F. K. Stock.

15 May 1902.

should be very glad if you would raise the limit, if you feel certain that it would still be a fair limit.

11088. Taking the butter over the whole year, those are the figures; and most of those butters which are below this limit are all congregated within about six weeks of the year—that is, all those which have a low limit are aggregated together in the late autumn, before the beasts are put into the byres for the winter. I come back to the point—under those circumstances, it might be of advantage to you to know what the country of origin is; of course, you would know the time of year at which the butter was passing through your hands, and if you got in the month of November or in the early part of December a sample of Friesland butter, and you got a number as low as 22 or 21, would you not say, from your experience, and from the fact that there is 12 per cent. of the butters at that time, which are known to have Reichert-Wollny numbers as low as 21, or 22, or 23 per cent.—"I cannot sustain any allegation that this butter is not genuine"?—I am pleased, indeed, that you have caught my point so far. That is the only reason why I made that suggestion, because I found there was a difficulty in looking through van Rijn's results.

11089. Of course, a large number of analytical determinations which have been made and published have been upon single samples, the product, for various experimental purposes, of individual cows, and, in some cases, very small herds?—Yes.

11090. It is the fact, as you will admit, that the butter which is imported into this country either is the product of large herds, or has come from creameries or factories?—Yes.

11091. That imported butter, therefore, more closely approximates to the average condition of butter than any single product would?—Yes.

11092. Therefore, any numbers that we may arrive at would be more applicable to foreign butters, in consequence of the foreign butter fat being, so to say, a statistical quantity, than they would be to individual samples?—Yes.

11093. Therefore, any numbers which we may suggest would be more easy of application to imported butters than they might be to individual samples produced in our own country for local consumption?—I quite agree.

11094. (*Sir Charles Cameron.*) I did not quite gather the number of specimens of butter that you have personally examined?—I stated that I had examined 105 samples from the county of Durham within the last twelve months.

11095. What was the particular object you had in making these analyses?—They were sent in under the Sale of Food and Drugs Act by the county inspectors.

11096. That being the case, what guarantee is there that those samples were all genuine samples, even those that had low figures?—The only guarantee was that they fell within the known limits for genuine samples.

11097. That would only apply ordinarily to the commercial article throughout the country generally?—That is so.

11098. Those results would not be as useful for our purpose as if the examinations referred to samples that were procured under circumstances that ensured that they were absolutely genuine?—I quite agree.

11099. You have given us, in fact, the composition of the ordinary commercial article?—Yes, just as it was bought all over the county.

11100. What conclusion can we draw with regard to the fixing of a standard in relation to them, when we do not know whether the low figure specimens were genuine or not?—I think that one might assume that they were genuine, because the fixed fatty acids do not rise above the figure for known genuine samples.

11101. That is the problem we are engaged in solving—how low we can go down and still have the genuine article?—Yes.

11102. Your results would not give us any definite information, unless we knew that the article undoubtedly was genuine?—This is the point, so far as my results are concerned—that for known genuine samples there are known limits for the lowest.

11103. What I want to find out is what were the lowest figures you have obtained from your own observation of samples that were undoubtedly genuine, because you cannot go much by what you get as a commercial article?—That is so. I have not got such figures here, but I have, for my own information, made numerous analyses of known genuine butters.

11104. Samples of undoubted purity, which you knew yourself to be pure?—Yes, samples obtained for the purpose.

11105. What were the lowest figures you obtained, and what proportion of those samples had a lower figure than 24?—I never got so low a figure as 24 in what I knew to be genuine samples.

11106. You did with the commercial samples, but not with those that you knew to be genuine?—Yes.

11107. Do you not think that there is a certain significance to be attached to that fact?—That is so, and still one finds other operators getting these low figures from known genuine samples.

11108. We must get as much information as we best can upon the examination of samples of undoubted purity. The samples that you knew to be undoubtedly pure, you say, you never got so low as 24?—That is so.

11109. What was the lowest figure?—With a known genuine sample by the ordinary Reichert process, I never got lower than 12·5—that would be about 25 with the Reichert-Wollny.

11110-11. What was the maximum figure?—I got as high as 34 Reichert-Wollny for a known genuine sample—that would be about 17 Reichert.

11112. Would you be inclined to fix one standard for the analyst in a case of prosecution, and to make that single standard the official standard, or would you have several standards—I am speaking of processes?—If my suggestion should be applied, one would be in a better position to judge of what the standard should be. Still, I think, looking upon the success of a standard for the sale of milk, it would certainly be of great advantage to have a fixed and definite standard for butter.

11113. Would you fix one standard form of analysis?—As I have already said, I would have two tests: I would take the Reichert-Wollny figure and the Hehner figure together. They cover rather different ground.

11114. Would not that involve an enormous amount of trouble to the poorly-paid public analyst?—I do not think it would; I should never shrink from the trouble myself, because it would only be, possibly, one case in 50 in which you might have to take the trouble.

11115. Many analysts have them almost every week?—Then I am fortunate.

11116. Do you not find that a very long time is required for the Hehner method?—It is a tedious process, and one that requires carrying out with very great care; but it is admirable when you do get it carried out. I should rely upon that test as a basis of calculation, certainly.

11117. That process is almost universally abandoned by the public analysts, is it not?—I think it takes too much time.

11118. Do you think it is superior to the other method?—It seems to me that by it you get something absolutely definite, something that you can see, and handle, and weigh. In the other case you are surrounded, probably, by little difficulties here and there. I certainly do like the Hehner method when it comes to a matter of absolute quantitative determination.

11119. In the manipulation, do you think as concordant results would be obtained by different analysts by that method as by the Reichert-Wollny method?—Speaking from my own experience, if the analyst is expert, he can do the Hehner method without any difficulty whatever, and he can get absolutely good results. On the other hand, the Reichert-Wollny method is an exceedingly good method, but it is open to certain objections.

11120. When you speak of the Hehner method, do you mean not only the determination of the insoluble fatty acids, but also the determination of the soluble fatty acids?—I mean just the determination of the insoluble fatty acids, because by the Reichert-Wollny method you get an expression of the soluble fatty acids—you do not get all of them, you get an aliquot part of them, so to speak; it is arbitrary, but you do get a certain proportion.

11121. It is empirical, no doubt?—That is quite so; but it is constant, in a sense.

11122. A proper examination, made correctly by different chemists, will always give concordant results by that process, will it not?—Yes, if they take the same sample.

11123. I think you suggested that the analyst, in the first instance, should not be informed as to the source of the butter?—That is so; he should be unbiassed absolutely.

11124. Would not that always necessitate a second certificate?—I do not think it would.

11125. You have stated that the analyst, in the first instance, should merely get the sample of butter, without any information as to its source, and then, when he had made his report upon it, he would be informed as to its source, so that he might modify his previous analysis; is not that rather a kind of reflection upon him?—I do not think so. He would not issue a formal certificate in the first place; but it would be quite open for him to communicate with the inspector, and ascertain where the butter came from.

11126. Generally speaking, when an analyst makes his analysis, does not he write his report in the form of a certificate, and send it very frequently by post?—Quite so; but in my own case, if I found a sample of milk just hovering on the lowest standard, or rather below it, I should have no hesitation whatever in writing to the inspector, and asking him under what conditions that sample was taken; whether he took it from the first milking of the cow, and so on; and then it would be for him to correct his own mistake. We have had an instance where there was a 50 per cent. deficiency of fat, and we actually had a prosecution, although the man had seen the sample taken from the cow. He was an ignorant inspector, and there was a lot of trouble about it.

11127. After this day, the 15th of May, you will not continue doing that, will you?—No.

11128. (*Mr. Gibbons.*) In the early part of your evidence you told us that in cases of prosecution your analysis was often confronted by that of another analyst, who gave a very different report; does that not rather take away from the value of these analyses?—A defence analyst is paid to say something that the other man is not paid for.

11129. You do not really mean that?—I do mean it, and I am sorry to say I have had very frequent illustrations of that fact.

11130. (*Sir Charles Cameron.*) Are you referring to a difference in the interpretation of the results, or a difference in the actual results arrived at?—They agree upon the figures, but the analysts' opinions differ.

11131. (*Mr. Gibbons.*) Two analysts have samples of the same butter sent them. You, for the prosecution, give your analysis, and then do you find that very different from the analysis given by your brother analyst?—The figures would agree.

11132. Then how can you be confronted with his analysis, if the figures agree?—The other analyst says, "I know what this butter is; you do not. I say that it is a Russian butter of low quality, and you have taken it as an average quality butter, such a thing as you are used to, and therefore you have misjudged the figures, and made a mistake." That is what it comes to. The magistrates are not technical experts, and they say, "If you did not know that this was Russian butter, and that man did know it was Russian butter, you are out of court altogether, and we dismiss the case." That is what happens.

11133. When we have had so much evidence that there there is very little difference in the constituents of butter, whether it is made in New Zealand or in Finland, how can that arise?—I shall be very glad when magistrates see that evidence and read it, which is a thing that they are not in the habit of doing, I am afraid.

11134. (*Mr. Dunn.*) You said, I think, that you would give special latitude to milk, if it were the milk of one cow. Would you give special latitude to butter if it were made from the milk of one cow?—If I knew it was so, I should certainly judge it in that particular light.

11135. You have recommended that there should be different limits for butter coming from different countries, but have you quite made up your mind as to what limits you would give to butter from the various countries?—I could only do that on the figures that I have got; they are not my own figures. Naturally, one would have to take the lowest limits if one must include all the butters coming from the various countries.

Mr. W. F. K. Stock.

15 May 1902.

11136. Is there much variation?—There is very considerable variation, according to the figures I have. The lowest limit for German butter is 27, Reichert Wollny or Reichert-Meissl, as the case may be; in this particular instance the figure was arrived at by the Reichert-Meissl process. The two methods agree practically; it is a technical point, but in one case a solution of baryta is used, and in the other a solution of soda for neutralising the acids—that is the difference between the two. As I have said, the lowest limit for German butter shown by the figures I have is 27, and for Italian butter 20·63. One could not include the German in the Italian, because the German butter is evidently very much higher in volatile fatty acids, and they are not in the same class at all. Professor Thorpe has just corrected me, and told me that there is a very close assimilation when the samples are got generally from dairies or from large herds, and I am not sure whether this Italian figure was obtained from the butter of a single cow or not, or whether we import Italian butter into England. Otherwise the figures approximate fairly closely. German has 27 as the lowest, Siberian 22, American 27, Swiss 28·5, French 26, Holstein 27·3, and Austrian 24·42. I quite accept what Professor Thorpe said, as I am quite sure he would not have said it unless he knew it was so.

11137. You see it would be a serious complication to have special figures for each country?—Yes, and that was why I wanted to put the figure down fairly low, and why I wanted to know the origin of my sample; but I do not want to be biassed in my analysis. I want to do my analysis first, and to know about the country of origin after.

11138. (*Mr. Gilchrist.*) You stated first of all that you would approve of a Reichert-Wollny number of 21, and then I think you altered it to 22?—I said that I had gone down as low as 21 in these 105 samples, not that I would approve of that figure as the limit, because I suspected that sample.

11139. What was the Reichert-Wollny number you said you would adopt if a figure was fixed?—22.

11140. Did you alter that in any way after the explanation by Professor Thorpe?—I said after Professor Thorpe's exposition to me of the evidence that you have had here that I was putting it very low.

11141. I think you also said that you wished to put it low, because you did not want honest people to be prosecuted for a genuine sample?—Yes, that is just what I said.

11142. Have you had any prosecutions in which a defence was successful, and proved that they were genuine samples?—No. As I explained to the Committee at the beginning, I have always been fortunate in having a large proportion of foreign fat in my samples, which was absolutely margarine, and so there was no question whatever about it. In such cases the difficulty comes to nothing. But where you get from 10 to 15 per cent. of foreign fat, there the difficulty steps in.

11143. If we tell you that from an institute in the midlands of England, we have had the butter sent in showing Reichert-Wollny figures of 22·5, 23·5, 22·4, 22·3, and 21·7, in five consecutive months during last season, would you still say that 22 would be a safe number to adopt?—I think it would be exceedingly fair in a case of that kind. You would not include those as adulterated butters, if you took 22 as the limit; they would be treated as genuine.

11144. Then we had some Yorkshire samples, which came in October showing 19·9, in a case known to be genuine butter?—That must be one of the singular exceptions.

11145. (*Professor Thorpe.*) Will you run your eye down this table (*see* page 577), and see what is the general character of the Reichert-Wollny numbers given. The samples dealt with in that table represent butter obtained from all parts of the United Kingdom, and are fairly representative of the produce of the United Kingdom?—I see that my number of 22 would be a low number.

11146. Having to fix a limit, do you think, under the circumstances, that 24 would be an absurdly high number for this Committee to recommend in terms of the reference to them?—If you do that you will have to do what was done in the case of milk; you will have to issue a rider circular, and you will have to empower

Mr. W. F. K. Stock.

15 May 1902.

county councils and other authorities to make inquiry into these cases, and to deal with them as a Committee of Inquiry. If you issue regulations which will empower committees to make inquiry into cases of this kind, then your standard of 24 Reichert-Wollny would be quite a fair standard. It approximates much more closely to the whole of the figures on this table than mine does, but it would not cover certain doubtful samples, upon which you cannot make up your mind without considerably more inquiry than the analyst is capable of making under the present circumstances.

11147-9. It is a matter of opinion as to how far an explanatory circular in the particular circumstances was required at all, so to some extent I am with you there. The explanatory circular was, perhaps, issued under a particular set of conditions, which were contemplated by the original terms of the Committee's recommendation, but inasmuch as the Board of Agriculture did not accept the Committee's recommendation with regard to the particular limit in the case of fat, the explanatory circular, perhaps, was not so urgently needed in that case as it might otherwise have been?—That is so.

11150-2. Do you still tell the Committee that you think if we put up the standard from your suggested figure of 22 to 24, that would necessitate the issue of this explanatory circular?—I think it would, I think you would find you would have this difficulty of the place of origin cropping up. Magistrates have not had the advantage of all this information before them as you have had. As a matter of fact, we have no stipendiary in the County of Durham—I am speaking now of my own experience; and we depend upon an unpaid magistracy, who neither have the time nor the inclination, probably, to make themselves masters of questions of this kind, and they never do so. We go before them under the most unfortunate circumstances, when we appear in food and drug cases. We are met by irresponsible people who say this, that, and the other. You know it is quite possible to stretch a point without telling a lie. This is what happens to us, and very often we have great difficulty in securing convictions. When you learn that we have got a fine of 6d. for a case of 52 per cent. deficiency of ethyl-nitrite in a sample of sweet nitre—that shows what happens. Fines are nearly always based on that kind of ground—it is very unfortunate. That is why I think if you fixed a lower limit you would probably clear the ground of a great many disputed cases, whilst at the same time you would be opening the door to the addition of foreign fat to butter, which ought not to be allowed. That is a difficulty that you have to face often, and the question is whether it would not be better as you suggest to put up the limit, and then allow a certain license to the prosecuting authority for them to make inquiry into the origin of the sample, and to make any correction which is necessary after that. I think that would be a very excellent thing, and if it came into the hands of the analyst, there would not be much mischief done; it is only when it gets into irresponsible hands that the mischief arises.

Mr. H. Wedin.

Mr. HUGO WEDIN, called; and Examined.

11153. (*Major Craigie.*) You are Commissioner in Great Britain for the Kingdom of Sweden, I believe?—Yes.

11154. What Government Department of Sweden has appointed you?—The Board of Agriculture.

11155. How long have you been in this country?—Since 1887.

11156. Where are you appointed to reside?—At Manchester.

11157. Does your sphere of operations extend to the whole of the country?—Yes.

11158. Is it your duty to report on the trade in Swedish agricultural produce, especially dairy produce, in this country?—Yes.

11159. I believe you have some evidence which you wish to give to the Committee on more than one subject connected with butter?—Yes.

11160. Is it in relation to the volatile acids in Swedish butter that you wish to mention any investigations that have been made?—We have had very few investigations as regards the volatile acids in butter, but there have been a few as regards milk fat; Professor Nilson, of the Royal Agricultural Academy, has made some investigations of that kind.

11161. Perhaps you will permit me to ask you a question of a general character before you go into detail. What is the nature of the Swedish legislation on the subject of the purity of butter at the present time; is there a general law in Sweden on the subject?—We have a Margarine Law.

11162. Is that a recent law?—Yes.

11163. In what year was it passed?—It came into force on the 1st April, 1899.

11164. Has there been any change within the last two years?—Yes, there has been a change lately; I have not the Act before me, but it is more stringent than before.

11165. Your Government have not supplied you with any statement of the law?—No, they have not.

11166. I think you propose to suggest to the Committee some means whereby a guarantee or control of the butter exported can be established?—Yes.

11167. Have you anything to state generally as to the character of Swedish butter?—As a rule, I rely upon the honesty of our farmers and butter-makers and shippers. We have very few shippers, and I should say those are honest men. With the stringent clauses that we have in Sweden, we are quite on the safe side, so far as adulteration is concerned.

11168. You have not found any necessity, then, for a special control of the butter exported from Sweden?—So far as my experience goes, it would not be necessary. We have had no cause up to now, and I do not think we shall have any in the future.

11169. Can you give the Committee any idea of the particular parts of Sweden from which the exported butter chiefly comes?—Most of the butter comes from the south and the middle; there is very little sent here from the north.

11170. South of Stockholm, do you mean—south of the great lakes there?—Yes.

11171. Does it come direct to this country in great part, or through Denmark?—About half of the Swedish butter comes *viâ* Denmark, and the other half comes direct.

11172. Is the proportion that comes through Denmark as large as one-half?—Yes, nearly. In 1900 we exported 377,000 cwt. Of these, 196,000 cwt. came direct to England, and 181,000 cwt. went through Denmark. Of that which went through Denmark, part was sold to the importers in Denmark, and the other part was transhipped to this country.

11173. Then, the whole of the butter that goes from Sweden into Denmark is not sent on to this country, but part of it may be consumed in Denmark?—Yes, but a very little of it, I should say—about 15,000 cwt., or something like that. At present Finnish and Russian butter is sold in Denmark; formerly Swedish butter was sold there much more than it is now.

11174. I believe the export of Swedish butter to Great Britain commenced a good many years ago?—Yes, it commenced in 1864. We had a little before that, but it was a very small quantity.

11175. And the amount that comes now is what you have just stated to us?—Yes, there was about 8,000 cwt. less in 1901; the Swedish export has been decreasing for some years.

11176. Can you give an extract of the most recent Swedish law with regard to the export of butter?—Yes: "Every person who exports, or tries to export, margarine without keeping it in vessels duly made and marked as prescribed, shall be sentenced to fines of from 200 kronor up to 2,000 kronor (from £11 to £111), or imprisonment. The article shall also be confiscated, or, if it cannot be brought back, the guilty person shall pay its money value. Of the fines, and also of the value of the confiscated goods, one-third shall go to the Crown and two-thirds to the prosecutor. Any person making butter or cheese for sale is prohibited from making, or allowing anybody else to make, margarine or margarine cheese in his dairy, and it is also prohibited to store margarine, oleomargarine, or other fats used for making margarine on premises where butter for export is packed or stored."

Mr. H. Wedin.

15 May 1902.

11177. Is there any export of margarine from Sweden to this country?—We did not send 1cwt. last year to England, and the export has always been practically *nil*.

11178. Is there any import of margarine into Sweden?—Only a very small quantity—4,780 cwts. only in 1901.

11179. Is there some manufacture of margarine there?—Not much; about 5,000,000 kilos—perhaps it might be a little more now, but reliable figures are wanting.

11180. I think there is some margarine for sale in the shops of Gothenburg?—Yes. As a rule, the peasants in Sweden do not like margarine; it is sold in the towns, but very little of it is sold there.

11181. I believe you wish to say something about the control in export, the method in which it is exercised, and the mode in which samples are taken?—It would be a heavy expense for us to take thousands of samples every year if we had to do this for many years, and, perhaps, not find one case of adulteration in many years—which is what happens now.

11182. Is anything of the kind done now?—We have 22 dairy inspectors in Sweden. They are travelling about the dairies and looking after them, as a rule.

11183. Have you the results of any analyses that have been made as regards exported butter?—I have not any with me.

11184. What is the course that you would suggest to this Committee generally?—If there be a case of adulteration found, it would help us to suppress it if we were able to know at once about it. Through the courtesy of Professor Thorpe and the Board of Agriculture, we have been promised that we shall be informed, as soon as possible, when the Customs' authorities take samples, and find that there is adulteration.

11185. When a sample is found by the Customs of Swedish butter which is adulterated, is the fact reported to you?—Yes. If there should be any adulteration found here, I should take the case up at once, and get the people prosecuted in Sweden.

11186. Do you propose any further step in that direction?—The only thing is that if such a case were to happen now in Manchester or Birmingham, or anywhere else in the country, I should not get to know about it from the local authorities.

11187. At present you have no means of knowing that a local authority has found an adulterated sample?—No, but I would like to know at once.

11188. Have you had any local cases brought to your knowledge?—I have not heard of any.

11189. (*Professor Thorpe.*) Can you give the Committee any idea how your export of butter compares with the export from Denmark?—Our export last year was 369,000 cwts., and the Danish export was something like 1,300,000 cwts.

11190. Does the greater portion of your exported butter come to the English market?—Very little goes to other markets; only a few thousand cwts. will go to other countries.

11191. You have told the Committee that about half of what you export goes through Denmark; is its identity as Swedish butter lost when it goes through Denmark?—It is very difficult to say. As a rule, they do not mark it at present; Danish butter is marked. Swedish butter from Denmark seems to be marked "Swedish" or not at all—*i.e.*, neither Swedish nor Danish.

11192. Do you mean that your exporters do not mark it?—Some mark it, but I cannot say that all do. I know that they have adopted marking it very much this last year.

11193. When your butter goes to Denmark I suppose it goes to Copenhagen and is re-shipped from Copenhagen?—Yes.

11194. It never comes here from any other Danish ports?—There is a very small quantity coming *viâ* Frederichshaven.

11195. (*Professor Thorpe.*) Anyhow, all your butter would be re-exported from ports on the eastern side of Denmark?—Yes. The export from Frederichshaven is only 500,000 lbs. (Danish) a year.

11196. When that butter comes to England it will come in a Danish ship probably?—Yes.

11197. Is there anything to indicate that it is not Danish but Swedish produce?—Only if it is marked by the shippers in Sweden, and if the marking is not removed—but that is another point which I do not know.

11198. Is it possible that they would remove the marks in Denmark?—I should say it is not impossible, but I should not think it is done. It is difficult for me to answer the question, because I have never seen it done myself, but people say that in some cases the marks might be removed.

11199. When it comes in a Danish ship, is there anything to tell the English Custom House officer that it is Swedish butter?—No, but I think that the Government of Sweden is now taking some steps to have this changed.

11200. Up to the present nothing has been done?—Up to the present there has been no such action.

11201. Then the Custom House officer would naturally enter it as Danish produce?—I suppose so.

11202. When that Swedish butter comes into the English markets is it sold as Danish produce?—In some instances. I suppose they sell it mostly as Danish in the shops, but the importers do not.

11203. The shopkeeper might represent it as Danish butter?—There is no doubt of it.

11204. Does Mr. Faber sit quietly under that?—So far he has done it. Our butter from the south of Sweden is as good as the Danish butter, and even better, the Danes themselves say.

11205. Then Mr. Faber does sit quietly under it?—Yes, he accepts that. I might say that the butter from the middle and north of Sweden is not quite so good for a small part of the butter only, because some dairies are very small there. In the south we have dairies that produce up to 120 casks a week, but in the centre they would only produce ten or eight casks a week, or even only one or two casks in some instances.

11206. When is the suggestion that you have made, that the Government will mark this butter as Swedish produce, likely to come into operation?—They proposed to mark it "Swedish" in December of last year.

11207. Who has proposed it?—There was a meeting at the butter competition at Gothenburg. They think that if the Danes are going to mark their butter, we must do the same. The people would like to have it sold as Swedish butter.

11208. We wish to encourage them to do that?—We prefer to have it marked, even if we get a little lower price. I think that is a fair thing. As it stands at present we do not get credit for our best butter, but we do get credit for our worst. The butter that is shipped direct is of slightly lower average value, the far larger part being quite as good as that sent from the south, or *viâ* Denmark, and the best butter, which comes from the south of Sweden, is sent *viâ* Denmark.

11209. Then are we to understand that the butter which comes through Copenhagen and is transhipped, is originally consigned to Danish merchants?—A good deal of it is, but not all. In 1900, 8,000,000 kilos. (that would be 160,000 cwts.) were transhipped *viâ* Copenhagen, and at present, I think, there would be 180,000 cwts. transhipped.

11210. If I understand you rightly this is butter which has been bought from Swedish producers by Danish merchants to be re-shipped to England, and which eventually comes into England as Danish butter?—The far larger part of it, but it is really difficult to say how much.

11211. That is a condition of things which has gone on in the past?—Yes. Whether they send it here as Danish produce, or as Swedish generally, I could not tell you.

11212. In Sweden is your margarine law as strict as the margarine law is in Denmark?—Yes.

11213. Is it the same law?—Practically.

11214. Is it the same procedure?—Not quite the same, but I do not know very much about the Danish margarine law.

11215. It is very nearly impossible, I may say, for Danish farmers to adulterate with margarine—the risk is so great that it is practically impossible; would you say that the risk was equally great in Sweden?—Yes, I think so.

11216. There would be very little danger of Swedish

Mr. H. Wedin.

15 May 1902.

produce or of Danish produce having its fair name impugned by any malpractices in Sweden in the way of the addition of margarine?—I have no doubt of that.

11217. Now with regard to this lower quality of Swedish butter, which you say is directly exported to England, and is never handled by the intermediate Danish merchant, what is that sold as in this country? —The butter from the central and northern parts of Sweden is sent *viâ* Gothenburg, as we have better steamers from Gothenburg than we have from Malmö, and the rates are lower. The Wilson Line, of Hull, have steamers from Malmö and from Helsingborg to Grimsby, and they have a steamer running from Copenhagen to Hull. It is quite as convenient, if not more convenient, to send from Copenhagen to Hull, because the ships there are a good deal better. The ships from Malmö are so bad that they often arrive too late for the market, and that, of course, causes loss to the shippers.

11218. Would this butter which comes *viâ* Gothenburg direct to England be entered by the Customs as Swedish produce?—As a rule it is. That butter too, as a rule, is marked, but that perhaps is not always the case with the butter sent from the south of Sweden. We should like to have that butter marked as well, because that would give us increased reputation.

11219. Is that butter which is known to the Customs to be Swedish, and which is received here in Swedish ships from Gothenburg sold in this country to the consumers as Swedish butter?—Yes, by the wholesale merchants.

11220. The wholesale merchants would know it as Swedish butter; but would anybody else know that? Would a grocer know it as Swedish butter?—I could not tell you. Some of it is, no doubt, known as Swedish butter, and some of it is not; that depends upon the wholesale merchants.

11221. How would it be sold to the consumer, if it were not sold as Swedish butter? Would it be sold to the consumer as Danish butter?—It might be so.

11222. Might it even be sold as Russian butter?—No; I do not think so; that would not be any advantage.

11223. If they sell it as Danish butter there would, no doubt, be some advantage?—Yes; but not for the butter from the south of Sweden, or the largest part by far of Swedish butter.

11224. I am speaking of the butter which comes direct from Gothenburg; you do make an attempt to sell that as Swedish butter?—Yes; but there is very little difference between the two. I should say the average price of Swedish butter is not even 1s. per cwt. (and Danish and Swedish are usually quoted alike) lower than the average price of Danish butter, according to the quotations.

11225. Have you any system in Sweden of competitions, and of marking and assessing the value of the butter, similar to that which they have in Denmark? —Yes; we have fortnightly competitions at Gothenburg and Malmö during about 28 weeks of the year.

11226. (*Mr. Gibbons.*) Is the butter in Sweden generally made in farmhouses, or in factories or in creameries?—Most of it is made in creameries at present. It is difficult to say how much is made at the farms, but we can get at that by the number of the cows; we have in Sweden 1,750,000 cows.

11227. Do you know the price per Imperial gallon that the factory people give the farmers for their milk? —As a rule, in the summer it is about 3½d., and in the winter it might go to 4½d. and 5d. per gallon.

11228. What is the quantity of butter-fat in it generally?—Generally 3·5 per cent., or 3·3; it is a little over 3 per cent.

11229. In the total quantity of the butter which the Danes claim to send to England, would that which they have bought from your country, Sweden, be counted?—Yes; our total make of butter at the creameries in Sweden was, in 1900, 500,000 cwts.; that is the total for all the creameries in Sweden. About 130,000 cwts. was consumed in Sweden and the rest was sent out of the country.

11230. What proportion of your milk would be made into butter as against that made into cheese?—That is very difficult to say; we have really no statistics enabling me to tell you.

11231. (*Mr. Dunn.*) As I understand, you have no special experience about the quantity of volatile acids in Swedish butter?—No. I am very sorry to say we have had no analyses made. The only things we have are the records of this investigation by Professor Nilson, of the Royal Agricultural Academy at Stockholm. He found what was, perhaps, rather a peculiar thing about the amount of volatile acids. From October to April he found that there were more volatile acids in the morning milk than in the evening milk; but that during the other months of the year there was no difference. He thinks the cause of that is the light, because he says we have in the summer much light, but in the winter it is very dark.

11232. That inquiry has not been followed up by more recent investigation on the subject?—No; I am sorry to say we have nothing else to go by. Professor Nilson has some figures as regards volatile acids for the first month after calving, the second month after calving, and so on, and also for the different months of the year, and he expresses his results in Reichert figures. Two of his examples show 16·72 and 15·49. He found that the first two months were very high in volatile acids, that in seven other months it was about 14, then it went down to 12, and so on.

11233. (*Mr. Hickey.*) Is not nearly all the butter that comes from Denmark and Sweden to England retailed by the shopkeepers as Kiel butter?—I daresay it is.

11234. It is not called "Danish" butter or "Swedish" butter?—Some of it might be called "Danish," and the rest "Kiel."

11235. Is not the great bulk of it called "Kiel"? —That is difficult to answer.

11236. Would you say that the best butter made in Sweden is sent to Denmark, and afterwards transshipped from there to England?—Yes.

11237. Would you say that the butter which comes from Malmö to England is of inferior quality to the Swedish butter which is sent to Copenhagen, and then comes to England?—No; that is the same butter, only a small part of it is sent direct now.

11238. By "inferior Swedish butter," do you mean the butter which is sent from Gothenburg to England? —No inferior or low class butter is exported. The great bulk by far of the butter from Gothenburg is quite as good as any from Malmö, Helsingborg, or Copenhagen; but a small part, chiefly from small dairies in the north and middle of Sweden, of slightly lower average quality, is included in the butter from Gothenburg. Copenhagen is now the great centre for buying butter, and as a rule the buyers there can give rather a high price for the butter.

11239. Can you tell the Committee why none of that butter goes to Denmark from Gothenburg? Would it be owing to the greater expense that would be incurred by sending the butter from Gothenburg to Copenhagen that that butter does not go to Copenhagen, but comes direct to England?—That is the reason, no doubt.

Mr. J. K. Colwell.

Mr. James Kear Colwell, F.I.C., called; and Examined.

11240. (*Chairman.*) You are the public analyst for the Metropolitan Boroughs of Holborn and Finsbury and the Borough of Bedford; and you are also a Fellow and Member of the Council of the Institute of Chemistry?—I am.

11241. How long have you occupied your present official position?—About 12 years; that is as public analyst for Bedford and Clerkenwell, which is a portion of the new Borough of Finsbury.

11242. Have you conducted many analyses for those authorities for whom you act?—Between 2,000 and 3,000, I think.

11243. You have read the Reference for our Committee?—Yes.

11244. May I ask whether you agree generally with the Interim Report and with the Regulation that has been made in pursuance of it, as regards the percentage of water in butter?—Under all the circumstances, I entirely agree with the recommendation.

11245. Do you think that the procedure in the courts will be simplified by the passing of the Regulation?—Yes.

11246. As regards the other constituents of butter, do you recommend that standards or limits should be fixed for the guidance of analysts and of the courts?—Undoubtedly I do.

11247. Have you heard objections raised to the fixing of any standard for such a product as butter?—Yes.

11248. On what ground?—On the ground that it is possible for the blenders of butter to reduce their product with margarine, so that the mixture will just come within the limit; and thereby, of course, to materially increase their profit.

11249. Do you think that, in order to avoid hardship in the case of honest, but rather low quality butters, the standard would have to be fixed low, and that there would be a tendency to adulterate butters down to that standard?—Exactly; you must have that circumstance with all natural products.

11250. But still you think that some standard must be fixed in the public interest?—I do.

11251. Have you examined any Russian butter, or other foreign butters, having abnormally low Reichert-Wollny figures?—Yes, I have examined a good many samples of butter—more especially recently—giving a low Reichert-Wollny figure. When I have estimated the insoluble fatty acids (which I regard, with the Reichert-Wollny figure, as the chief things to be estimated), and, when I get a figure of 89, with a Reichert-Wollny figure of about 24, which is certainly suspicious, I cannot say definitely that that butter is adulterated. Although one feels that it is probably adulterated—one cannot absolutely swear to it, and one would not be prepared to swear to it in a court of law. Most of the cases, I may say, have come in my private practice, rather than by being submitted to me as a public analyst. I have, in many cases of this kind, felt bound to say in the report—"I am not prepared to say that the sample is adulterated, but it is extremely suspicious."

11252. There can be honest butter, which is chemically indistinguishable from good butter adulterated down to a low standard?—Undoubtedly, if you mean by "honest" butter, an article which does not contain physically added margarine. That is the case at the present time. You may get abnormal butters, which give you figures similar to mixtures containing a small quantity of margarine.

11253. Would you recommend that, in making a Regulation, the Government should rely upon a single test, that is, upon the Reichert-Wollny test alone?—I think the Reichert-Wollny test affords a very excellent figure, if it is suggested that the Government should take one figure; but I should back it up by the insoluble fatty acids. These two figures would make a reasonable standard. The making of a standard, I take it, would mean that you would not absolutely say, supposing your Reichert-Wollny figure fell somewhat lower than your standard that the sample was adulterated, but you might call upon the vendor to prove that it was a genuine butter, although abnormal.

11254. In an official standard, you would rely upon two tests?—Personally, I should.

11255. At what figure would you place the two tests; take first the Reichert-Wollny number?—I should say anything giving a Reichert-Wollny figure below 24·5 would be suspicious.

11256. What would you put as the Hehner figure for the insoluble fatty acids?—I should put that figure at 89.

11257. Do those two figures correspond?—They correspond fairly well.

11258. In the event of there being no correspondence between them, would you give the vendor the benefit of the more favourable figure?—At present, I think I should give the vendor the benefit of the doubt.

11259. Is it your opinion that, by proper treatment, the butter can be kept up to a fairly high standard?—Yes, that is my opinion. I have formed that opinion after talking with many importers of butter and butter-producers generally; they all seem to agree that there is not the slightest doubt that, if a standard were made, it would be worked up to.

11260. What are the chief factors in determining the quality of butter as regards the soluble fatty acids; has the period of lactation anything to do with it?—I am afraid I can hardly say much on that point. I think the period of lactation has not a very great effect upon it, except just before and just after calving.

11261. Has the feeding?—The feeding, undoubtedly, has, I think, some effect upon the amount of volatile and of soluble and insoluble fatty acids. It has recently been noticed, especially in the case of Dutch butters, that the cows give increased volatile fatty acids after they have been stabled and fed. I think that Dr. van Rijn says that he has found that the cold nights have had considerable effect in reducing the quantity of soluble fatty acids.

11262. With regard to the other tests which analysts apply, such as the iodine test, the specific gravity, and so on, would you allow them to be brought in as evidence in proceedings in court, assuming that your standard were fixed, or would you let them remain merely for corroborative purposes in the laboratory? What I want to arrive at is how much reliance you would place upon the other physical and chemical tests?—I think you could admit them as evidence, but, personally, I should not mention them in reporting.

11263. Are you absolutely satisfied with the tests that you suggest, or do you think that they are only the best that can be applied in the existing state of our knowledge?—In the absence of any method of analysis, which will enable an analyst in all cases to say *that* is a butter containing margarine, and *this* is a butter containing no margarine, I think these two are the best that you can have, but improvements must eventually be made in the methods of examining butter. At present, under existing arrangements, I think they are the best that can be had.

11264. I suppose what all chemists want to find is some way of accurately and directly determining the presence of foreign fats?—Exactly, with certainty in all cases.

11265. It has been announced recently, at a conference in Brussels, that a chemist has discovered such a method, but that he is not in a position yet to give the public the advantage of his information. Would you yourself expect any results from such research?—One cannot say; he may have discovered something which will enable us to say *that* is a butter containing margarine and *that* is a butter free from margarine, distinguishing between the two; but I do not think, even supposing there were prospect of something of that sort, that it need prevent the present adoption of a standard.

11266. Have you done any research work yourself?—A little.

11267. Are you hopeful of further discovery?—Not at present.

11268. (*Professor Thorpe.*) Even now there is no difficulty in discriminating, by chemical analysis, between what is legally margarine and butter?—Quite so.

11269. Nothing is wanted now to perfect the methods of analysis to distinguish margarine, which, at most, contains 10 per cent. of butter, and butter?—Yes.

11270. Where the difficulty comes in is in the determination of 5 or 6 or 7 per cent. of margarine added to butter?—Exactly, but this depends to some extent on the nature of the butter used in making the mixture.

11271. I suppose there would be no difficulty in determining where there would be 20 per cent. of margarine in butter?—I think not, unless the margarine has been mixed with a butter containing a high percentage of volatile and soluble acids.

11272. The difficulty only arises in the case of small admixtures?—Yes.

11273. I gather that you are strongly impressed with the desirability that a limit, or some criterion of quality, should be fixed by Regulation?—Yes.

11274. On the whole, you suggest that at all events one of these limits should be a Reichert-Wollny number of 24·5?—Yes.

11275. In addition to that, you suggest that a Hehner number should be given, and that you suggest, I think, should be 89?—Yes.

Mr. J. K. Colwell.

15 May 1902.

11276. You do that, being familiar with the terms of the section, which simply states that a presumption may be raised at that point?—Yes.

11277. You are, of course, aware that butters may, from time to time, occur with a lower Reichert-Wollny number than 24·5?—Yes.

11278. But you yourself think that such occurrences are relatively so infrequent, that, in the public interest, the presumption may fairly be raised at that point of 24·5?—Yes. And I think that if 24·5 were fixed as a standard the abnormal butters would be weeded out.

11279. You think the operation of a standard would be to weed out these honest, but abnormal, butters?—I think so; the farmer and butter producer would endeavour to produce a butter which would conform to the Regulations.

11280. Is that always within his control?—I think he should know what he is sending out, and that it can and should be within his control.

11281. That presupposes that he himself analyses the butter before he sends it out?—No, I do not think so. I think he will observe his cows, and feed and treat them properly, and he will see what are the conditions necessary for the production of butter of the proper standard.

11282. No doubt information can be given to him which will put him on his guard. He can, as in the case of the Friesland and similar butters, stall his beasts a little earlier in the autumn, and give them a rather better character of food?—Yes.

11283. Is that what you meant by his improving the conditions?—Yes.

11284. (*Mr. Gibbons.*) I think you referred to the possibility of the quality of the butter being improved by the proper treatment of the cows?—Yes.

11285. Can you tell us what the proper treatment should be?—Proper conditions of housing and feeding, I take it, generally.

11286. By their being warmer or colder?—By keeping the cows in a suitable temperature, and under proper conditions as to feeding and housing. The Dutch have found that the cows give less soluble and volatile fatty acids when the animals are out at grass and are being kept out at night in the cold seasons. Such things as that can and should be remedied.

11287. I observe that the highest Reichert-Wollny numbers are reached during the most severe months of the year—that is, during January and February, when the figures are much higher than those obtained in May and June?—I think with the Dutch butters, September and October are the months for the lowest soluble and volatile fatty acids.

11288. September would be a splendid month in Holland, would it not?—I do not know, but I suppose so.

11289. There would be no cold nights then?—I suppose the nights begin to get cold then.

11290. Not in September surely; I have been there in those months?—I have not.

11291. It is a most equable climate in September; have you found by practical experience that you can improve the quality of butter by the treatment of the cows?—My authority for saying so is Van Rijn, who states that the reason why the soluble and volatile fatty acids are low in September, October, and November is because the cows are out at grass, and the nights are getting cold, and the soluble and volatile fatty acids drop in consequence. Further, there must be a cause for the production of those abnormal Dutch butters, and the most likely one is the condition of feeding, housing, and treatment of the cows.

11292. Supposing a limit is fixed, can you give us any ready method by which a farmer or a producer of butter can know that he is keeping within the limits of the law?—I am afraid I cannot.

11293. You do not know of any simple, ready method by which a farmer can be sure now that he is not transgressing the law?—I am afraid I cannot suggest a method that you could put into the hands of a farmer, of doing chemical analyses.

11294. Can he ascertain as a fact that he is keeping within the limits of the law by any other method than going to an analyst?—I think not, if you mean that he is to ascertain as an absolute scientific fact.

11295. Is it not a very important consideration when fixing a standard that a man shall be able to know whether he is keeping the law or breaking it?—It is an important matter. It would be a difficult thing for a man to know whether he is invariably sending out milk up to the standard or not without analysis.

11296. When a man is making butter in his own dairy, how can he know whether he is within the limits of the standard or whether he is outside it?—If he makes his butter properly, I think he will very soon learn how far he may go.

11297. But only through the analyst?—Only through the analyst, if he wishes to be certain on a scientific basis.

11298. (*Mr. Dunn.*) As I understand it, you are of opinion that fixing the standard at a Reichert-Wollny number of 24·5 would have the effect of weeding out those farmers who could not comply with the standard?—Yes.

11299. Can you say that butter with a low Reichert-Wollny number is inferior as human food?—No, I do not think you could say that.

11300. Would it not be rather hard to weed out this valuable human food simply because it did not comply with a scientific test?—I think these cases would be so extremely few that no damage would be done, especially with English and Irish butters.

11301. I am afraid that the evidence which has come before us goes to show that a considerable percentage at times might come below that number?—I have not found it so.

11302. It has not been your experience?—No.

11303. You suggest that the cattle might be better fed; but surely sometimes poor farmers cannot comply with all those conditions; is that not so?—They may be poor farmers; but if they can keep cattle at all they can easily keep them properly. Moreover, the protection of the "poor" farmer who cannot feed his cows must not stand in the way of preventing wholesale adulteration. It is the business and duty of the producer to produce the normal and genuine article that he is asked for.

11304. (*Mr. Hickey.*) In the *précis* of your evidence you say that it is within your experience that there has been a considerable addition to the number of doubtful cases giving low Reichert figures?—Yes, recently, since the decision on the Russian butter case—about twelve months back, I think.

11305. You say you have strong grounds, which you are not at liberty to lay before the Committee, for believing that large quantities of produce are being placed upon the market as butter which are adulterated with small quantities of foreign fat?—Yes.

11306. Have those samples come before you professionally?—Most of these samples have come before me through private clients.

11307. Have they been foreign butters or home-made butters?—They have been called all sorts of butters, but I have no reliable information as to their source.

11308. What do you mean by a low Reichert figure in the case of those special samples to which you refer?—Many of those samples have given Reichert-Wollny figures of 22·5 or 23·5, anything below 24·5 I should call a low Reichert figure.

11309. Were those samples taken by the inspectors and sent to you for analysis?—No; most of those samples have been submitted to me by private clients who were buying.

11310. (*Professor Thomson.*) Is it your opinion that analysts require or wish for some official support through that standard in giving their reports?—Yes; as far as my personal friends are concerned they are all extremely anxious that a standard should be fixed.

11311. Do you think that the majority of analysts are desirous of having a standard?—I think so; those to whom I have mentioned the subject are certainly in favour of fixing a standard.

11312. (*Mr. Gilchrist.*) You have stated that the conclusion you have arrived at that the standard should be fixed at the Reichert-Wollny number of 24·5 throws the onus of proving that they have supplied genuine butter upon the vendors; if they prove that it is genuine, of course, you would not expect a conviction?

Mr. J. K. Colwell.

15 May 1902.

—No. Under existing circumstances I should not expect a conviction. It must be remembered that to make profit by insufficient or improper feeding and treatment, and thus to produce an abnormal article, ought to be regarded as an offence in the nature of sophistication.

11313. How long should the party who sells such a butter remain free before he is brought into court again? I am thinking of the difficulty that has arisen in connection with vaccination; we do not want to be persecuting people. Have you fixed any time within your own mind at which the vendors of such butters should be free?—No, I presume samples would be taken in the usual course by the inspector. Sometimes the inspector will take butter cases generally or similar things to butter which are sold in shops. A man is not often sampled more than twice a year at the present time—very often not even so frequently as that, because the authorities often do not carry out the Acts to a sufficient extent.

11314. (*Mr. Hickey.*) Would those samples of butter that show such very low Reichert-Wollny figures be butters that had been specially prepared to be submitted to you for analysis?—I do not think they had been specially prepared to be submitted to me; but I think they had been specially prepared for sale.

11315. Do you think some of them were imported from abroad, and intended to be sold in the ordinary way?—I could not say.

11316. Would you think that the home-made butters among them were intended to be sold in the ordinary way?—I do think so, because several of my clients were buying for the retail trade.

11317. (*Mr. Gibbons.*) Would any actual damage occur to the purchaser if he bought butters that gave a Reichert-Wollny figure of only 21·7, or were he to buy a butter giving a Reichert-Wollny figure of 31·6, would he be benefited by getting that instead of getting the former butter?—I should hardly like to give a reply to that question. If you mean damage to health, it is more in the nature of a medical or physiological question.*

11318. Would the purchaser be damaged if he bought a genuine butter which gave a Reichert-Woolny figure of only 21·7. The vendor could say that he was selling genuine butter of abnormal quality.*

11319. (*Chairman.*) Is the food value of butter with a very low Reichert-Wollny number as good as the food value of a butter with a high Reichert-Woolny number?—That is an extremely difficult question for an analyst to answer, and I should prefer not to answer it.

11320. (*Mr. Gibbons.*) You would not like to say that it was as good?—No, I should not.

11321. (*Professor Thorpe*) Are you a member of the Society of Public Analysts?—No, I am not. I was a member of the Society called by that name, but I resigned at the beginning of this year.

11322. Therefore, I presume, you did not get a circular, addressed from the society, asking for opinions on this question of the fixing of a standard?—I do not remember to have received such a circular.

Major CHARLES EDWARD CASSAL, F.I.C., called; and Examined.

Major C. E. Cassal.

11323. (*Chairman.*) I believe you are Public Analyst for the Royal Borough of Kensington, the City of Westminster, the Metropolitan Borough of Battersea, the Borough of High Wycombe, and the county of Lincoln (administrative counties of Kesteven and Holland, Lincolnshire)?—Yes.

11324. You are also District Agricultural Analyst for the county of Kesteven (Lincolnshire), Consulting Scientific Analyst to the "British Medical Journal," Fellow and Past Censor of the Institute of Chemistry of Great Britain and Ireland, Joint Secretary of the International Commission on Adulteration and Fellow of the Sanitary Institute of Great Britain?—Yes.

11325. I think you were for several years Chief Demonstrator in the Department of Hygiene and Public Health of University College, London, and that you are also editor of the "British Food Journal"?—Yes.

11326. Do you come to give evidence in your private capacity, or have you been instructed by the public authorities for whom you act to come before us?—I have been instructed by two of my authorities, the Council of the Royal Borough of Kensington and the Council of the Metropolitan Borough of Battersea, to represent them; and I also, of course, appear in my individual capacity.

11327. Have you given a great deal of thought to the question that is before the Committee, whose Reference, I presume you have seen?—Yes.

11328. I understand that you have conducted a large number of analyses of butter yourself?—Yes.

11329. Have you seen the Interim Report of this Committee dealing with the percentage of water in butter and the Regulation that has been made upon it?—I have.

11330. Are you in agreement with the Recommendation and the Regulation?—I agree that there should be a limit, and that the limit fixed is a desirable limit, under all existing circumstances. I do not know that it is within the power of the Committee, but I rather regret that the statement was made that persons who sold butter containing more than 16 per cent. of water might protect themselves by notification as to the composition of the article sold.

11331. After all, that is a question of law, and I do not know that we need go into that now?—Quite so; I only mention it because you have asked me, and several members of the two authorities I have mentioned have referred to that point, and have expressed regret that some steps could not have been taken to deal with that notification.

11332. Having seen the Reference to the Committee, you are, of course, aware that this Committee had absolutely no power to deal with a question of law in any way?—I quite understand that.

11333. Have you made up your mind that some standard ought to be fixed to deal with the constituents of butter other than water?—I have, and I think there is no doubt that it could be done.

11334. Why do you think it is necessary? Is it for the guidance of analysts and the Courts?—I think that it is necessary for the guidance of analysts and of the Courts; and I also think that it is necessary for the protection of the public, and of the vendor of genuine products.

11335. Are you in agreement with what was done in the case of milk? Quite—except this, that when giving evidence before the Milk Committee I advocated a standard of 3·25 for fat, and the figure recommended is 3; still, I agree, that under the circumstances, perhaps, the Committee could not see their way to recommend a standard of 3.25 for fat.

11336. (*Professor Thorpe.*) As a matter of history, what the Committee did recommend was 3.25?—Yes, so they did; but the Board of Agriculture did not accept it.

11337. (*Chairman.*) On the same grounds, do you consider that an analogous standard should be fixed for butter?—I think so. I have sent in a statement as to my reasons for that position, and I do not know whether the Committee would wish me to read it. It is a matter on which it is difficult to define one's position without some kind of preliminary statement, and as there is a good deal of difference of opinion on this matter, I thought it might be well to set down in writing the reasons that lead up to the position which I take on the matter.

11338. I think we can give you an opportunity for stating your reasons, without missing any of the points which you have made in your statement; perhaps that would be a little more useful to the Committee, who,

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* The matter cannot be considered quite from this point of view. Damage to the pockets of consumers generally arises if butters of this character are allowed to be placed on the market without question or hindrance, and to permit this opens the door to a vast amount of fraud of the direct kind. (*Note by witness.*)

Major C. Cassal.

15 May 19

as you know, have taken a great deal of other evidence on the point?—Let it be quite as you please.

11339. Would you kindly tell the Committee what standard you propose?—As a result of my experience I would recommend that a presumption should be raised that a butter is not genuine—first, if the Reichert figure obtained by operating with all due precautions upon 2·5 grammes of fat is notably below 12; secondly, if the insoluble fatty acids figure is notably above 89; and, thirdly—preferably, but not necessarily—if an adverse indication is given by the Zeiss refractometer in addition.

11340. Taking your three recommendations in order, as I understand the Reichert figure that you take is the Reichert-Meissl figure, the method adopted where 2.5 grammes of fat are taken being called the Reichert-Meissl, and that where 5 grammes are taken being called the Reichert-Wollny?—These names are applied to it. It is a little inconvenient, I think, to designate processes by means of names, though it is very commonly done. Of course, there is a variety of modifications of these things. But it may be taken to mean that. It means the same operation carried out on 2½ grammes of fat with all possible precautions that are known to prevent error in carrying out the process.

11341. I presume you would not mind doubling the grammes of fat and doubling your figure? I only suggest that because the majority of analysts seem to prefer the larger figures in each case?—We all differ.

11342. But you do not attach much importance to the difference?—No. I have some grounds for not liking the operation when carried out on 5 grammes; I do not think it is quite as much under control, and there are other reasons with which I need not trouble the Committee. Of course, it follows that if you multiply the Reichert figure obtained on 2·5 grammes by the proper factor, you can get a very close approximation to the figure that would be obtained by the Reichert Wollny process.

11343. Now to take your second test, the Hehner figure of 89; by placing that second, do you mean that you rely primarily on the Reichert figure, and that you attach less importance to the Hehner figure?—I do not attach less importance to it. The Reichert figure is less troublesome to obtain, but I attach a good deal of importance to the insoluble fatty acids figure when properly obtained, because it is a figure obtained by a process which different analysts ought to be able to carry out in such a way that they can get practically the same result. In the Reichert process, in order that results may be comparable it is necessary to operate with the same kind of apparatus, and in precisely the same manner. In the case of the insoluble fatty acids figure that objection does not apply; I mean that any two analysts ought to agree very closely in the figure that they obtained for the insoluble fatty acids. I may perhaps say that my reason for mentioning these three things is this: It is considered by some that the institution of official definitions and the establishment of official limits and standards would tend to make a machine of the public analyst. In my opinion there is no real danger in this respect, in regard to butter particularly, if no single figure obtained by some single official method of analysis is laid down as the official standard; I refer here particularly to the Reichert and Reichert-Wollny figures. That is why I mentioned those three things.

11344. You prefer a double test on the ground that it is likely to be less mechanically operated by the analyst?—That is so.

11345. I should have thought that in a matter of this kind the more mechanical the process was the better? Does this kind of work call upon the imaginative faculties?—It does so, I think, rather more than is generally admitted or understood.

11346. Ought it to, is what I rather meant?—The difficulty is that if you convert the public analyst into a machine you ultimately produce a somewhat unintelligent officer. In my opinion the public analyst should not be a mere machine for obtaining and registering analytical results and drawing stereotyped conclusions from them according to some inelastic and invariable rules. It is essential that he should be an intelligent and independent officer with full freedom to exercise discretion and to apply his knowledge and experience to the solution of the various problems, new and old, with which he is constantly called upon to deal. It has I know, been urged by those who object to the fixing of standards and limits, that the fixing of those limits and the fixing of an official process would tend to convert the public analyst into a mere registering machine with practically no intelligence—as it is said the gas examiners of the London County Council are, for instance, on the same grounds. The Reichert process involves the ordering of an official method and an official apparatus which tends in a mechanical direction. The insoluble fatty acids figure and the refractometer indication have not this objection attaching to them, and I prefer to see a public analyst founding his opinion upon more than one indication, particularly if some of them are not based on an official mechanical operation.

11347. Are we not confusing two separate things? We are all anxious that men engaged in scientific operations should cultivate the spirit of research, but with men doing this actual work, which I presume must be done with great exactness, and which cannot be done with any of the elasticity which we all prefer in our work; surely it is better that they should be as strictly as possible confined to certain definite lines of procedure? I take it that what we are all aiming at is uniformity in these things?—That is so.

11348. It seems to me that you want to get rid of the dull level of uniformity and to substitute therefor a system in which the personal equation would play almost a predominant part?—Not a predominant part.

11349. At any rate, a very important part?—An important part.

11350. Then there would be no uniformity?—I do not think that would follow in regard to the other two processes that I have referred to. It certainly would in regard to the first where the personal equation undoubtedly comes in. I have felt that this point about the reduction of the public analyst to a mechanical condition is a point of some difficulty, and I have sought to make a suggestion which would to some extent obviate that. I do not know that there is any harm in having more than one limit or standard.

11351. (*Professor Thorpe.*) With you and everybody else, I have no desire to make the analyst an unthinking machine. I do not suppose anybody will ever charge me with that. But, at the same time, everybody accustomed to judicial procedure and administrative work knows perfectly well that the less room there is for difference of opinion, and the less room there is for what you call the personal equation in all matters of this kind, the better it is in the interests of justice. I am sure you will agree with me that there is nothing which more greatly clogs the wheels of justice in matters of this kind than the Bench having to be confronted with analytical operations, the relative value of which they have no means of assessing. One analyst takes a particular process, and gives his results in good faith, another analyst says, "I do not agree with that method at all; it is not what I practise"; and he gives his results in his own terminology. What is the unfortunate magistrate to do? You must be aware, I am sure, that that is a condition of things which does not conduce to the interests of justice?—I quite agree.

11352. In the abstract, therefore, it is to be advocated that analytical procedure shall, as far as practicable, be made uniform and consistent, with due regard, of course, to the advances of knowledge in perfecting such procedure?—I quite agree with you.

11353. You have stated that in your judgment the ordinary Reichert-Wollny process is accompanied by a large measure of personal equation?—It is perhaps not so much personal equation as differences in the operation and differences in the apparatus used. It is for that reason, no doubt, that in the process which has now become an official process for determining the quantity of butter in margarine, specific instructions have been laid down as to the apparatus that is to be used, the chemicals that are to be employed, the time that is to be given to the operation, and so forth. It is rather on that account that I made my statement.

11354. Do you mean that you deprecate the laying down of those conditions?—I do not like the laying down of official processes to be rigidly adhered to, if it can be avoided. I agree with you that it cannot be entirely avoided, but I should like, by the introduction of one or two other processes to which these objections do not so much apply, to leave rather more discretion to the public analyst than if he only has that particular process to rely upon, and is compelled only and solely to use that process. I feel that it is a difficult thing to make my meaning clear on the point, but my reason for bringing it forward and for suggesting the other figures is because I do not like the tendency to institute an absolutely rigid official process alone.

11355. The whole course of our procedure is full of examples of prescribed modes of doing things. For instance, we assess the beer duty, and we collect the spirit revenue by means of apparatus that have been legally defined; Sikes' hydrometer, for example, is a legal instrument, and it has to be done in that way?—Yes.

11356. Such a course laid down after due inquiry is attended with an enormous amount of convenience?—I quite agree, but with some objections.

11357. What are the objections?—Take Sikes' hydrometer as an example. I do not know that I ought to carry the thing too far, but it is within my knowledge that considerable difficulty has been caused by the fact that Sikes' hydrometer is an official instrument. I have had occasion recently to examine some of these instruments which were incorrect, but upon which large firms were basing the composition of their spirits. That was rather a dangerous thing. I was compelled to teach one particular firm the method that we adopt in the laboratory for determining the exact percentage of alcohol.

11358. It is no objection to the principle of Sikes' hydrometer if a particular hydrometer has not been standardised and due care has not been taken that it is correct?—No, but I mention it as an example of possible dangers attending rigid official methods. I do not want to be led too far on this point, because in reality I am in full agreement with you as to the advisability of, and, indeed, the necessity for, an official limit and an official standard for butter, and that you must also make use of the Reichert process, and therefore that you must lay down an official method of procedure. But as a public analyst I should like also to see (it really is not a matter of very great or vital importance) the use of one or two other processes which I say are more satisfactory in the sense that the actual prescription of apparatus and prescription of procedure are not so vitally necessary as in the case of that first one. That is really the only intention that I had. I do not want you to think that I am making it a matter of any vital importance.

11359. I quite see your position, but I venture to think that it is rather a sentimental one than a practical one?—Perhaps it may be so.

11360. (*Sir Charles Cameron.*) I think I understand what you mean. You mean that the individuality of the analyst is not to be altogether ignored, and that you would allow him to arrive at the desired result by whatever process he may think it desirable to adopt?—As far as possible.

11361. For example, with regard to the determination of the insoluble fatty acids, you would not define any process, and you would not prescribe any particular quantity of liquid that he should employ in order to wash out the soluble fatty acids?—That is so.

11362. And you would not prescribe the exact quantity of alcohol and potash, and so on, with regard to the Reichert-Wollny method?—That is so. I should expect that if I found a sample of butter to yield 89 per cent. of insoluble fatty acids, my colleagues, even if they did not operate in the same manner as myself, would also find 89 per cent., or what was practically 89 per cent., within the limits of experimental error.

11363. There is this little practical difficulty: if one analyst used three or four times the quantity of liquid in washing out the soluble fatty acids, some of which are very soluble, like myristic acid, the analyst who used a smaller proportion of liquid would not have exactly the same result?—There are of course dangers of that sort in all these food processes, but when that particular process is carried out properly—and it is so well known that there is no necessity to describe it—I think the results are generally found, even when different methods are employed, to be very closely concordant.

11364. When the results of the examinations of two or more analysts are to be compared, do you not think there is a great deal in what Professor Thorpe has stated with regard to employing identical instruments and identical quantities; would that not be a great advantage?—I think so, most certainly.

11365. With regard to the examination of butter, as we know you have made a great many examinations?—I have.

11366. I suppose the butters that you have examined have not always been those that have been taken by the inspectors of food?—Not always, but very largely so.

11367. The great majority, should you say, have been taken by them?—Yes.

11368. You have examined a number of specimens of undoubted purity, I presume?—I have.

11369. Specimens as to which there could be no doubt as to their purity?—Yes.

11370. What is the lowest figure that you have got on the Reichert-Wollny system?—I may say that I do not employ the Reichert-Wollny system.

11371. Well, take the equivalent process, which is based on the employment of 2·5 grammes of butter fat?—I have never found in a butter that was absolutely authentic a lower figure than 12 and a slight fraction over 12, operating on 2·5 grammes. Those "low" samples were samples of Dutch butter produced during the autumn, as to which this Committee, of course, understand the circumstances.

11372. What about English butter?—I am not able to give the Committee much information upon that, because, as you are aware, the great majority of samples of butter analysed by public analysts come to them from the inspectors, and the public analysts do not know their origin. There were only comparatively few samples of butter of which I knew the origin.

11373. Still, dealing as one can only deal with what you know to be undoubtedly pure samples of butter, not commercial articles, are you inclined to believe that a standard of 24 Reichert-Wollny would be a sufficiently low standard to take?—Quite low enough. I think that would be an extremely lenient standard.

11374. Do you think there would be many variations from that standard in 100 samples of genuine butter?—There would be very few indeed.

11375. (*Professor Thomson.*) I take it with regard to the question of official tests, that you really mean that all your difficulties will be overcome if three items in the butter are to be relied upon as standards?—Yes, I suggest that.

11376. You wish it to be based not only upon one, but upon three?—Yes.

11377. In your opinion as an analyst, in fixing your ideas upon standards, do you think it is because of the official assistance that the analyst would receive that he would like to have standards fixed? Do you find in giving reports that you would be in a stronger position if an official standard were made?—I think undoubtedly we should be. That, in fact, is one of my reasons for supporting the introduction of an official standard.

11378. From your knowledge of other analysts, do you think that they are also as a majority wishing for these standards?—I have no doubt that if the matter were properly put to the public analysts in the country, after proper discussion, there would be a majority in favour of the view which I now advocate. I do not know whether you are referring to the society called the Society of Public Analysts, which sent round some time ago a circular for information; but if that is the case, I may say at once that I do not consider that that society represents the public analysts in this country on this question any more than on any other.

11379. I merely wish to learn whether, from your consideration of the matter, it is your opinion that the majority of public analysts would be likely to go with you in that wish?—I am quite sure of it, if the matter were properly put to them.

11380. (*Major Craigie.*) Could you suggest to the Committee how you would phrase a Regulation upon that double standard? Is it proposed that the butter shall satisfy all three tests before the vendor is put on his defence to prove it genuine?—That is what I suggest at any rate with regard to two of the tests, namely, the Reichert figure and the insoluble fatty acids figure; and I have said that preferably, but not necessarily, an adverse indication by the Zeiss refractometer in addition might be introduced. I see no reason why these two or three requirements should not be put down in some Regulation in the same way as the requirements relating to milk have been put down in a Regulation.

11381. You are probably aware that the Milk Committee suggested a somewhat complicated standard—a governing limit, and then other particular factors were

Major C. E. Cassal.

15 May 1902.

to be satisfied; but it was found on the discussion of that Recommendation that the public, as a rule, could not grasp what the Committee suggested, and selected only one of the standards. Would there not be a great difficulty in getting the courts and the public generally to understand the delicate manipulation of three standards balanced against each other, as you propose?—Probably it would be difficult to get the courts to understand these things. As the result of a fairly extensive experience of that kind of work, I may say that it is extremely difficult to get the courts to understand the most elementary points connected with analytical processes. That objection I am afraid you must always have; I do not see how we are to get away from it.

11382. There would be more loopholes to escape the operation of the law if there was a complicated scale before the court?—Of course, the more complicated it is the more difficult it is; but the mere introduction of such a thing as a Reichert figure into court, and the consequent possible necessity for the public analyst or some other expert to explain to the Bench what that means, is quite complication enough, and I do not think it matters how much more you add to it.

11383. You have no hesitation in recommending to the Committee that they should suggest to the Board of Agriculture an actual Regulation setting up a standard; I mean you have no hesitation on the ground that the standard may not meet all abnormal cases?—I have no hesitation whatever. I may say that I have in the précis of my evidence given my reason for putting that view forward. The recognition of abnormalities can be carried to such an extent that if reasonable limits and standards are not fixed, an enormous amount of adulteration must be permitted; and this is particularly the case in regard to butter. I have been astonished to learn that some of those who advocated the fixing of limits for fat and non-fatty solids in milk have urged that it is not desirable to fix limits with respect to butter-fat. To my mind such an attitude is wholly indefensible, and in fact amounts to stultification.

11384. (*Mr. Gilchrist.*) Do you have prosecutions now in the courts with regard to butter which is supposed to be not genuine?—Frequently.

11385. Are those prosecutions sometimes successful in obtaining a conviction?—Practically always, I think. My authorities have very rarely failed to get a case, and have never yet failed on a scientific point.

11386. Would you in a few words explain the difference of procedure between the present time, and as compared with what it will be if we fix a standard?—I gather that you mean, with what weapon am I armed when I go into court now in support of the certificate.

11387. That is the point?—I am afraid I must answer it at some length, because it is only in that way I can make my answer to your question clear. The terms "genuine" and "adulterated" are differently interpreted by different persons; and the meanings which can at present be attached to those terms when used in connection with the administration of the Food and Drugs Act are not clearly appreciated. It is commonly, and wrongly, assumed, and it has been wrongly assumed by the Legislature, that these terms are in all cases either obviously applicable or obviously inapplicable, whereas the applicability of one or the other to any given article is a matter with regard to which a correct decision is often extremely difficult to arrive at. It is also commonly, and wrongly, assumed that scientific methods of analysis must of necessity enable a sharp line of demarcation to be drawn in all cases between articles of food which are genuine or pure, and those which are adulterated or impure, whatever may be the nature of the article and whatever may be the nature and degree of the adulteration or impurity. It is no doubt on account of the assumptions referred to that the provisions of the Food and Drugs Acts make it incumbent on public analysts to report whether the articles submitted to them are genuine or adulterated in the absence of any definition of those terms, and that until quite recently no steps have been taken by the adverse indication by the Zeiss refractometer in addi- Legislature to bring about he establishment of official standards and limits. Public analysts have been compelled to make definitions, and to establish standards and limits for their own guidance, and they have had, and still have, to do this without official assistance, at a cost of much time, labour, and money. It is plainly unfair and undesirable that such burdens should be placed upon the shoulders of public officers; and it is also undesirable, and against the public interest, that the whole duty of deciding what shall and what shall not constitute genuineness and adulteration in regard to each and all of the great variety of products which are submitted to them, should be placed in the unaided hands of individual public analysts. The definitions and limits which public analysts have adopted have necessarily been based upon all the scientific facts which it has been possible to obtain in regard to the chemical composition and character of the various articles to be dealt with when in such condition as to preclude the possibility of their having been tampered with; and inasmuch as these definitions and limits are in existence with respect to butter, and, broadly speaking, are generally accepted and acted upon, there appears to be no valid reason against some of those being made official. What I mean by that is that public analysts have had to make limits and standards for themselves, based upon the whole of the information which has been obtained by themselves and by other workers in the same field; and in going into court to support their certificates, they have had to support them by that amount of evidence of standards which are not official, but which have been formed from their own experience and that of others. For instance, in the case of milk, when the public analyst has had to go into court and support a certificate to the effect that a sample of milk had had 50 per cent. of the original fat abstracted, that statement has been based upon the knowledge obtained from the thousands of analyses which have been made, which show that normal milk does not yield less than a certain percentage of fat.

11388. (*Professor Thomson.*) That is hardly an answer to the real question put to you, is it? The point is, do public analysts want the support of an official standard?—We undoubtedly do. We are met frequently in court with the objection that the standard which is set up by us has not received the official sanction of the Government. I have known that to serve as a very successful defence in several instances, with the result that there have been undoubtedly miscarriages of justice. I may perhaps give the case of vinegar as an example. I believe I was the first to have a prosecution for vinegar which contained less than three per cent. of acetic acid. I issued a certificate certifying adulteration, and the matter was referred to Somerset House, which took the same view that I did, and confirmed my certificate, with the result that there was a conviction. That was the setting up of a standard by a public analyst which was backed up in that case by the Government authority. In all cases the backing up may not necessarily take place, and I think that is a very strong argument in favour of the officialising of the standard.

11389. (*Mr. Dunn.*) Having regard to the question of the personal equation, do you prefer the Hehner, or the Reichert-Wollny, method?—I think there is more likelihood of personal error in the Reichert system than in the other system, because different methods are used by different analysts in carrying out that process, and the results obtained by that process are dependent to an important extent on the method and apparatus employed. That is an argument in favour of the view that specific methods of operation should be laid down for the process.

11390. If that were done, do you think that would be the best process in this respect, that it would be most likely to produce correspondent results?—I should think the insoluble fatty acids method would be more likely to produce correspondent results, but I should say that the process is not so delicate a one for detecting adulteration as is the Reichert process. I cannot give you off-hand the figures indicating the relative delicacies of these things, but there is a wider analytical range in the case of the Reichert-Wollny than there is in the case of the determination of the insoluble fatty acids. The range of the insoluble fatty acids is from 87·5, or 88, up to 95·5, but the range in the case of the Reichert-Wollny process is a range of cubic centimetres from 1 up to 25 or 26, or even 30. There is, therefore, as you will see, a difference in delicacy.

11391. (*Professor Thorpe.*) Do you mean that the range of genuine butter extends to as low as 1?—No, I mean the analytical range.

11392. (*Mr. Dunn.*) You recommend that three systems should be adopted?—I do, and especially I recommend the first two, if the Committee do not see their way to introduce the refractometer test.

11393. (*Sir Charles Cameron.*) Would you include the determination of the soluble fatty acids as well as the determination of the insoluble fatty acids?—No, I do not think that is necessary.

11394. You would only insist upon the determination of the insoluble fatty acids?—Yes. The determination of the soluble fatty acids is a troublesome and inconvenient process, which does not give very satisfactory results, and I do not think that the advantage to be gained is at all measured by the trouble that it would cause. Perhaps I might explain that point with regard to the term "genuine," because I think that is at the bottom of a great deal of the difficulty in this question. It appears to me that the difficulty felt in connection with the fixing of standards for natural products is due to the idea that the term "genuine" should not only cover the article of normal composition, but should also cover the abnormal product. There is no doubt that in order to avoid injustice the existence of abnormalities must be recognised to a certain extent in establishing standards under criminal Acts of Parliament. It follows from this that Governmental Regulations must invariably be based on low standards of quality. Such Regulations can never ensure the supply of high-class goods, or afford adequate protection to the producer and vendor of such goods, while, however, they can and should be framed in such a way as to check the grosser forms of adulteration. I think that much of the difficulty felt in this matter is due to the idea that the term "genuine" should be made to extend over far too wide a field. I see that Dr. van Rijn falls into what I think is the same error. He assumes that so long as there has been no physical admixture of margarine, or of foreign fats of any kind in the case of a butter, that that butter must be genuine, and the term "genuine" is properly applicable to it. In the same way it has been assumed that any liquid which can be drawn from the udder of any cow, from the mere fact of its being obtained from the udder of a cow, is, therefore, genuine milk. If that line of argument is held to be valid it would result in public analysts being compelled to pass as genuine samples of so-called milk which were not milk at all. You can draw all sorts of things out of the udder of a cow, and you can produce by bad conditions and improper methods of feeding and treatment, various articles to which Dr. van Rijn, and others who hold that view, would apply the term, "genuine." But I hold, if the public are to be protected, that the procedure indicated by that line of argument cannot possibly be followed. I think that it is one of the strongest arguments in favour of fixing a standard that people do put forward the view that the term "genuine" has got this very wide signification. I suggest that the term "genuine" should be restricted to butterr, the characters and composition of which fall within the limits which have been arrived at by repeated analyses of the normal article obtained under normally healthy and proper conditions. The analyses which have been made, and the results which have been published, are amply sufficient to show between what limits the figures indicative of genuine butter-fat vary; and the standards to be fixed should be based upon this information with a due regard to what the purchaser expects, and is entiled to get, when he asks for butter. The producer of butter, like the producer of any other commodity, is bound to take all the steps that are known to be necessary in order to produce an article having such a composition as to justify the application of the term "genuine" upon the lines which I have suggested. The production of a butter by methods which are known to give an article indistinguishable analytically from one containing physically-added margarine, in my opinion constitutes an offence in the nature of sophistication. The Acts of Parliament relating to adulteration clearly lay down the principle that the producer and vendor of an article are bound to supply the normal article, and that the absence of knowledge and experience on the part of the producer or vendor is no excuse for the supply of an abnormal article.

11395. (*Chairman.*) What provisions of what Acts lay down that principle?—The provisions of the Food and Drugs Acts prior to any Regulations, and particularly the important case of Dyke *v.* Gower, in which the late Lord Chief Justice held that the removal of cream form a counterpan in the process of serving customers was no excuse for selling to a later customer a milk denuded of a portion of its fat. That case can be looked up if you think it worth while. The late Lord Chief Justice said that it was the business of the milk vendor to see that he supplied the purchaser with milk, and he should know his business sufficiently well to ensure that the purchaser did obtain what he asked for.

11396. The milk was hardly normal when the cream had been abstracted?—That is so.

11397. (*Professor Thorpe.*) It was not normal, but it was genuine?—It was not normal, and it could not be regarded as having the composition of genuine butter.

11398. (*Sir Charles Cameron.*) It was not adulterated, but it was debased?—Yes. I should like also to point out this in regard to the Dutch butter question, which is well known to have been a considerable difficulty in this matter, and which is always quoted against public analysts now in cases of prosecution. It has been urged that if limits are fixed for butter fat they should be such as to admit of the exemption from condemnation of butters produced in Holland during the autumn—particularly during November—with which margarine has not been physically mixed. In view of the fact that if this course is adopted a vast amount of fraud could be perpetrated with impunity, I am opposed to the suggestion. There is no reason why the Dutch producer should not take the necessary steps to prevent the production of these abnormal articles. It has been done in other countries, and it can be done in Holland. With regard to this matter I may quote the following passages from the recently published work of Dr. van Rijn, the Director of the Royal Agricultural Experimental Station at Maastricht:—"I can now conclude, having established for a certainty that the abnormal chemical composition of Dutch butter during the autumn must be attributed to the circumstance that the farmers leave their cattle in the meadows until late in the year. I have also proved that the earlier stabling prevents the calling into existence of the abnormal composition under discussion. It is not my intention to say that all products imported from Holland, and showing an abnormal composition must be regarded as pure butter. . . . neither is it my intention to urge anyone to accept in the analysis of butter, a low figure for the percentage of volatile fatty acids, for this would only result in aiding frauds. . . On the 1st April, 1901, a new butter law came into force in Holland, and means are under deliberation to prevent butter of abnormal composition being introduced into the trade." That, to my mind, absolutely does away with the position of certain Dutch butter makers, and personally I fail to see why we should fix standards in this country, which would relieve the Dutch butter producers from doing their duty in producing the article which they ought to produce, and which would, at the same time open the door to the introduction of a vast amount of adulterated butter.

TWENTY-SECOND DAY.

Friday, 16th May 1902.

PRESENT:

Major P. G. Craigie (*Chairman*).

Sir Charles A Cameron, C.B., M.D.
Professor T. E. Thorpe, C.B., LL.D., F.R.S.
Mr. Christopher Dunn, J.P.
Mr. George Gibbons.

Mr. John Gilchrist.
Mr. Patrick Hickey.
Professor J. M. Thomson, LL.D., F.R.S.

Mr. A. E Balleine, *Secretary*.

Mr. Frederick J. Lloyd, F.I.C., called; and Examined.

Mr. F. J. Lloyd.
16 May 1902.

11399. (*Major Craigie.*) You appear here as representing the Bath and West and Southern Counties Society, and also the British Dairy Farmers' Association?—Yes.

11400. The evidence you will give, therefore, is on behalf of these associations?—Yes.

11401. Is it directly authorised by resolution of those bodies—that is, have you any resolution to hand in showing the nature of the evidence to be given on their behalf?—No; they simply asked me if I would give such evidence as I could.

11402. Then you would probably like to say that you are about to give chemical evidence on your own responsibility rather than that of the two bodies which you represent?—Yes.

11403. You have only a general commission from them, and not a particular commission?—That is so.

11404. Have these two bodies passed any resolution on the subject of the desirability of a standard for butter?—I think not, unless it be with regard to water.

11405. At any rate, you are not entrusted with a copy of any resolution that they did pass on that subject?—I cannot remember that any definite resolution has been passed by them. The only fact that I can remember is that both societies recognise the desirability of the 16 per cent. water standard, but object to the idea that disclosure should be sufficient where more than 16 per cent. existed.

11406. Do you mean that they object to the existing law upon that point?—They object to what is assumed to be the existing law; the question is whether it is the existing law.

11407. They do not agree, then, with the decision of the Courts, and they think that the law has not been rightly interpreted by the Lord Chief Justice?—I do not think the Courts have decided any case since the standard has been fixed; the standard only came into force yesterday. My own private opinion is that the idea of the Legislature was that the moment a standard was fixed by the Board of Agriculture, that should override any previous position of the law.

11408. You are not giving evidence now as a lawyer, but rather as a chemist?—That is so.

11409. (*Professor Thorpe.*) Surely a Regulation of the Board of Agriculture does not override the common law of the land?—Did not the law give into the Board of Agriculture's hands the power of making such a Regulation?

11410. (*Major Craigie.*) Only for the purpose defined in Section 4 of the Act of 1899, which does not repeal the Act of 1875. Is that not so?—Yes.

11411. (*Professor Thorpe.*) Perhaps you saw the answer which Mr. Hanbury gave to Mr. Redmond on that very point the day before yesterday?—I noticed that answer.

11412. That answer was given, as he expressly stated, by the advice of his law officers?—Yes. Of course, the law is impossible to understand; but that is how I understood the Act, at any rate.

11413. (*Major Craigie*). As you have raised this question, perhaps I might go one step further, and ask you—because it is rather important that the attitude of the bodies you represent should be quite clearly known to the Committee—whether those two bodies have not been aware of the present position of the law under the Act of 1875, according to which no offence could be committed where there was no fraud?—That is so.

11414. Did they not take that point into account in arriving at the conclusion that you have mentioned just now? Might I refer you to Section 6 of the Act of 1875, where the offence is, as you must know as an analyst, that of selling something to the prejudice of the purchaser—something which is not of the nature and quality demanded by the purchaser? It follows, does it not, that no question can arise as regards genuineness or any other point if the purchaser is not prejudiced?—I take it that those words, "of the nature demanded by the purchaser," had no definition prior to the exercise of the power of the Board of Agriculture to give them a definition, and that by fixing the standard those words are given a distinct definition that butter shall not contain more than 16 per cent. of water, and if it does it is to the prejudice of the purchaser, whether he knows it or not. That is how I look at the subject. Otherwise what use is the standard of 3 per cent. of fat in milk if it is not to the prejudice of the purchaser if he gets milk slightly below, and what use will be any standard that any Committee can fix unless that standard is to hold good?

11415. Putting it shortly, the objection to the present position of matters of the societies that you represent here is that no standard for butter would override the provision of the law which allows notice to the purchaser to be sufficient?—Yes, that is the position of both the societies.

11416. Their objection is not to anything this Committee have done or said, but merely they object to the law of the land?—If that is the law of the land.

11417. I presume you have read the interim report of this Committee on the percentage of water in butter?—Yes.

11418. In that report you will have observed that the Committee draw attention to the position of the law on the matter, and state that in making their Recommendation it is with reference to the existing law?—I did not notice that; I took it that the Recommendation of the Committee was to permit Irish butter to be sold containing more than 16 per cent. of water. I believe that is the general feeling of farmers, and I do not suppose they object to Irish butter; but what they do seem to object to is the milk-blended butter.

11419. Are we to understand that these societies, not understanding the present position of the law, interpreted the Recommendation of the Committee to mean something like an alteration of the law in favour of particular kinds of butter?—Yes, I think that was the idea.

11420. That not being so, we will go to the subject that we have more immediately before us to-day. You are not only representing these societies, but you have also taken a great deal of interest in the analysis of butter and in the prosecutions that have taken place under it?—Yes.

11421. You are, I think, a member of the Council of the Central Chamber of Agriculture, and you are acquainted with the discussions that have taken place there?—Yes.

11422. You are an analyst, but not a public analyst?—Yes.

11423. Your practice, then, is more with regard to private work?—Yes.

11424. Have you, in the course of your investigations, dealt with a very large number of analyses of butter?—No, not a large number. People talk of hundreds; my analyses would be more with tens, I think, than hundreds.

11425. Can you state what number of analyses you have made in the last three years?—Very few; nearly all my work was done years ago.

11426. What is the date when most of your analyses were made?—I should think the majority were made in the three years from 1887 to 1890.

11427. The cases included in the table which you are going to hand in to-day are dated 1888 and 1889?—Mostly.

11428. Are you going to put before the Committee the results of any other analyses?—No, I thought it was unnecessary.

11429. Therefore, the chemical conclusions which you propose to put before the Committee will be based mainly on experiments made some time ago?—Yes.

11430. Have you any reason to suppose that recent analyses of butter will in any way alter those conclusions?—No.

11431. I suppose you have not had an opportunity of examining some of the Russian butters or of the more recently imported butters like the Siberian butters?—No, I have not.

11432. They have not come under your notice?—No.

11433. But you have read the discussions on the subject and the reports of the cases that have been tried?—Yes.

11434. Still, nothing has transpired to alter the view that you express, based on the older experiments?—No.

11435. You are of opinion that there are certain butters now on the market which are, generally speaking, of an abnormal character on account of their local origin—Yes.

11436. What is that founded upon if you have not made any analyses?—It is founded upon general information and facts obtained.

11437. Your general information as regards butter leads you to believe that in certain localities the chemical features of the butter naturally differ?—Yes.

11438. Is that a question of climate and a question of latitude? How do you draw the distinction between localities furnishing normal butter and localities furnishing abnormal butter?—We know very little, I think, of the nature of the fluctuations in the nature of butter fat; undoubtedly butter fat is not a constant chemical compound. In all probability, I think it is a mixture of various chemical substances, and that these fluctuate is certainly due to the food, and probably to climate (which sometimes has similar effects to feeding), and also due to the time since calving. I cannot speak from personal experience, but I should think it is likely to be due also to the breed; certainly butter fat is not a uniform chemical compound.

11439. You are disposed to think that the climatic conditions of different countries may have an effect upon it?—Together with breed and feed. To limit it to climatic conditions alone perhaps would be limiting it too much; but, of course, in different countries we have different breeds, and we have a different nature of feeding; I think it is the combined action of the three.

11440. Would you say the treatment of the cows themselves as regards being out of doors, or being kept in the stable, has an effect upon the butter?—Yes, because that would alter the feed. I have known a case where the butter fat was quite abnormal prior to the animals going out on to the grass, and then it changed to a normal condition.

Mr F. J. Lloyd.

16 May 1902.

11441. Have you not had a great deal of experience in analysing butters made at dairy schools, and educational institutions?—No, they are not analysed.

11442. Have you not taken part at shows and butter competitions in the analysis of the special butters that have been exhibited?—A few have been analysed, because a difficulty in churning had led people to believe that they were not buying pure cream, but I have had very few samples for that purpose.

11443. You have no reason to suppose that butters made at such dairy institutes as we have now in this country would naturally differ in their composition from butters made in the ordinary practice for the market?—No, not personally from my own work; but, I think, theoretically there is some ground to suppose that they might because the butter made at these shows is very often made from imperfectly ripened cream. I rather incline to think that in the proper ripening of the cream more of the fat which was originally in the milk goes into the butter, whereas if the cream is not properly ripened a larger quantity of the fat goes away. I have reason to think that the fat which is recovered as butter and the fat which goes away are not the same. Nearly all analyses of butter fat have really been analyses of the fat recovered as butter; the analyses have not been of the whole fat which is present in the milk. That is an important point.

11444. Do you attach then special importance to the mode in which the butters are made at these schools and institutes?—I think it would tend to slightly affect the nature of the butter.

11445. In what respect would you expect to find the analysis of a dairy school butter—would you expect to find more or less volatile acid in it?—Less, I think.

11446. That is your impression—but you have not had any special experience in analysing these butters?—I have not.

11447. Has your attention been called to special methods of adulterating butter, such as putting starch into the cream, which is used for making butter?—I have found cream adulterated with starch, and I know that a great deal of cream is sold for butter-making; but I have not been able to prove the fact of that starch going into the butter.

11448. You cannot connect the two?—No.

11449. To what purpose would starch be put into cream?—Probably, it was put into thicken it—to give it the appearance of a thickness and richness which it did not possess.

11450. Such as the Milk Committee found had been done by the addition of glycerine to cream?—Or gelatine—gelatine is more frequently used.

11451. These are adulterations which have been brought to your notice in practice?—Yes, I have found those in cream.

11452. Would you be able to trace them in the butter made from that cream?—I could not say.

11453. Would the butter present any particular appearance?—I could not say, this is but theoretical.

11454. Have you also had some experience in the case of the butter powders which are used?—I have no experience with butter powders; but some years ago there was a deliberate attempt made by several people to sell a patent for making more butter out of a given quantity of cream than could be made by the ordinary method. I was called in on several occasions to witness the experiments by those who thought of purchasing the secret; however, they never allowed me, nor did they allow even the would-be purchaser to see the whole process; and the evidence therefore pointed to the conclusion that it was a case of deliberate fraud. The consequence was that the matter has fallen through so far as I know.

11455. Generally speaking, you come to advocate the Recommendation by this Committee of some standard of a chemical nature in dealing with the constituents of butter other than water; in other words, would you like to see a Regulation like that one made as regards water, passed as regards the other constituents referred to in Section 4, and in the Reference to this Committee which you have seen?—I do not know that I have formed an opinion as to what lines the Committee should adopt as the result of the evidence laid before it. I may say that in my private practice as an analyst I have found enormous difficulty in laying down any standard for the genuineness of butter. I have

Mr. *F. J. Lloyd.*

16 May 1902.

taken the best course I could find to determine when butter was genuine and when it was not; and I have found that the difficulty of fixing a standard was so great that I certainly would never believe that I could be within 25 per cent. of the composition. It would be very difficult to say for certain whether a butter was genuine or whether it contained, we will say, 25 per cent. of margarine.

11456. Therefore, I presume you would not desire to suggest to the Committee that they might trust to a single test in deciding the genuineness of butter?—There is still another point with respect to a single test. I am going to bring before the Committee a method which is essentially my own I believe; and it is the only test that I have found which gives any indication that is reliable of the quantity of margarine present in a mixture.

11457. This test, you think, would do so?—I think this test goes as far as any, but even this test will not allow me, with certainty, to say whether a sample is genuine butter, or whether it is entirely margarine, or if it is a mixture, in what proportion the two are present. I may mention one particular instance. Certain people wanted to put upon the market a material, and sent it to me for analysis as butter. I tested it in every way that I could think of, and reported: "This is not butter, it contains in my opinion at least 50 per cent of margarine."

11458. (*Mr. Hickey.*) Was that made in England?—I do not know where it was made—it was sent to me by London agents. They subsequently told me that there was not an atom of butter in that material; but that it was a preparation of cocoanut oil and other materials.

11459. (*Major Craigie.*) I think you are prepared to give the Committee the benefit of your research in this matter?—Certainly.

11460. And to suggest to them the method which on the whole you think is about the best you can think of for determining those constituents?—Yes.

11461. (*Professor Thorpe.*) You have told the Committee that your special and practical acquaintance with butter-testing was more particularly about 10 or 12 years ago, and that since that time you have done comparatively little in the analysis of butter?—That is so.

11462. Surely you must be aware that a very considerable improvement, and also a very considerable simplification in the method of butter analysis has been made during the last 12 or 15 years?—I cannot remember any method which has been improved upon, or which did not exist then.

11463. You speak in your précis solely of what is known as the Reichert process, and you state certain objections to the Reichert process. Now, the Reichert process itself has been very considerably investigated by different authorities, with the view of obviating those very disadvantages to which you make reference—for example, whilst it is perfectly true, as you say, of the old Reichert method, which practically sought to get all the so-called fats away, that the personal error might be great, it is the fact, is it not, that in modern modifications of the Reichert process those personal errors are very largely minimised?—They are minimised, but in my opinion they still remain.

11464. Why do you think they still remain, have you had in the first place much experience of the Reichert-Wollny process?—I cannot exactly say what is the special peculiarity which you would attach to the Reichert-Wollny method.

11465. If you do not know, it is not for me to tell you—that is the whole point of my examination. If you do not know what the Reichert-Wollny process is you do not know how those disadvantages which attached to the old Reichert process have been got rid of?—I know the Reichert-Wollny process, but I do not know the names sufficiently to distinguish each particular variation by the different men's names.

11466. You are aware, I suppose, as a matter of chemical history, that the original Reichert process which is now something like 25 years old at least, has been investigated first of all by Meissl, and then for a time the combined or improved process was known as the Reichert-Meissl process?—I do not know the history of this process, and I will not pretend to.

11467. Will you take it from me that the Reichert process has been so repeatedly investigated, and the conditions under which it can be worked, so definitely laid down, that a great many of the objections which you present to us, and which were based upon your experience of 12 years ago are now very largely removed?—I know they are very largely removed, but not entirely, because I carry out the process in the most modern way at the present day, and there still remains the difficulty, for instance, of two workers in a laboratory, each of whom believes that he carries out the process in strict accordance with the regulations, not obtaining the same results.

11468. Would you kindly tell the Committee how you carry out in the most modern way the Reichert process?—The method adopted in my laboratory is to saponify five grammes of butter with the glycerole of soda; then to decompose with dilute acid, and distil 110 cubic centimetres; then filter and titrate 100. I find that two workers, unless they distil exactly at the same rate, that 110 cubic centimetres, will not get the same results.

11469. Do you in your laboratory arrange the distilling at the same rate?—Each worker tries to distil at a particular rate—I know that.

11470. Within what time does he try to bring over 110 cubic centimetres?—I cannot answer that; I have not thought of it.

11471. But that is one of the points in the Reichert-Wollny process?—I know. That is what I say, that the results depend so much upon minutiæ which are personal errors.

11472. Pardon me, these are not personal errors?—Very well; they are minutiæ at any rate.

11473. They are attention to detail?—Attention to detail, which it is very difficult to get two assistants to carry out in indentically the same way.

11474. I am sorry to hear that that should be the experience in your laboratory; it is not our experience in the Government laboratory?—The Government, perhaps, are able to have better assistants. I know it is the experience in other analysts' laboratories, because only the other day a public analyst told me that he had found the same difficulty. I try to overcome all these difficulties by getting over the whole of the volatile fatty acids.

11475. Let us confine ourselves in the first place to this particular process. You say that in your experience two analysts cannot obtain concordant results even if they pay sufficient attention to the details which have been laid down by Wollny, and those who have come after him, to test how far that attention to detail is necessary; your experience is that concordant results cannot be obtained?—I do not say "cannot," because I believe the same assistant working twice over will get concordant results—I do not say they cannot be obtained—I do not say that two assistants could not obtain the same result; but I do say as a matter of practical experience that they do not obtain exactly the same results.

11476. You make that allegation?—Yes.

11477. That is within your experience?—That is my experience.

11478. Are you aware that this process, in so far as it was applicable to margarine as it is now defined, was the subject of an inquiry by a Committee appointed by the Society of Public Analysts?—No.

11479. I may tell you for your information that inasmuch as the existing Act of 1899 limits the amount of butter-fat which may be added to the margarine to 10 per cent., it was necessary, for the purpose of carrying out the Act, that some quantitative definition of 10 per cent. of butter-fat should be laid down; and on my invitation the Society of Public Analysts appointed a Committee to confer with me to work out the method which should be prescribed, and which should be binding upon all public analysts, as well as upon the Government laboratory, as to what methods should be employed to determine this 10 per cent. of butter-fat with the view of obviating discrepancies between the public analyst on the one hand and the Government laboratory on the other, which, as you know is a Court of Reference; so that we might be in agreement as to what we meant. Are you not aware that that was done?—No.

11480. This is news to you?—It is news to me. I only became a member of the Society of Public Analysts quite recently.

Mr. F. J. Lloyd.

16 May 1902

11481. Then you have not read the history of this subject, as it is contained in the journal of the Society of Public Analysts?—No.

11482. Our report was made to the Society of Public Analysts, and was published by them, and is continued in the "Analyst," but that has not been brought to your knowledge?—No.

11483. In testing this method every member of the Committee, and I may tell you that it comprised a number of gentlemen who were very well known for their connection with the analysis of butter—in fact, I may say every representative man in the society was put upon that Committee; every one of them independently took samples of butter mixtures prepared under my direction, and distributed by me. They were invited to make determinations of the amount of admixed butter by the method described, and they were on their honour not to divulge those results one to the other. The Committee met together, and each member brought the results of the analyses of these mixtures, containing 5, 6, 10, 15, or 25 per cent. of margarine admixed with the butter. The composition of the margarine was known, and the composition of the original butter was known, and it was perfectly possible for me to check the proportion of volatile acids. I knew the history of the whole thing, and I knew what the results should be, even before they were actually determined. You may take it from me as proved that various analysts by working under the condition thus laid down can get absolutely concordant results. The numbers furnished by those gentlemen from absolutely independent determinations made by those gentlemen were, I may say, practically absolutely concordant. I mean to say, that the differences that there were between them were only differences of two-tenths or three-tenths in the actual value of the Reichert-Wollny number determined?—Could they determine the difference between 5 and 6 per cent. of added margarine?

11484. No, and that is not the point, because they would not know the original composition of the margarine. I do not say they could determine the difference between 5 and 6 per cent. of added margarine, but what I say is that these various analysts did get absolutely concordant Reichert-Wollny numbers, which is what you disputed?—No; I do not dispute that you can get these numbers. What I say is that in practical working there are difficulties arising. Naturally, if men have special work to do they take special precautions. In the ordinary work of a laboratory there are difficulties connected with the obtaining of these results which, in my opinion, are overcome by determining the total volatile fatty acids.

11485. That is a little vague, and I do not know quite what you mean. The point I wish to make is that assuming a method like the Reichert-Wollny method is prescribed, and the details are laid down as they were laid down in that particular report, which is now binding, as I say, upon public analysts, and which they have accepted, and under which they work, then any number of analysts working in that way can get substantially the same result?—Yes, I quite believe that.

11486. In other words, therefore, this disposes, I think, of your first objection to what you call the Reichert method, namely, that the personal error is great. My point is that if the Reichert method is carried out as it should be the personal error is not great?—Then we must agree to differ.

11487. I appeal to fact—not to surmise. I appeal to actual quantitative determinations that have been issued to prove that point. It is not a question of opinion, it is a question of fact?—I think that personal errors are likely under special circumstances.

11488. I do not mean carelessness and slip-shod work. That is another matter than personal error. Personal error is something inherent in the method and which is part of the experimental method. I am assuming ordinary analytical care, and I am not assuming slip-shod work or carelessness on the part of the operator. I am assuming that persons do their duty as analysts, and then the personal error is very small. In other words, the experimental error, for that is the real thing, is very small?—You have just changed the word "personal" into "experimental." I do not state that the experimental error is great, but I do find from my own experience that the individuality of the assistant is so great that there is a tendency to overcome, if I may say so, the strict conditions under which absolutely concordant results can be obtained.

11489. That is not the individual in that sense; it is not the temperament of the individual, except in so far as the individual is careless?—Is it not a fact that the amount of volatile acids obtained will depend upon the rate at which distillation takes place? That is my experience.

11490. In the Reichert-Wollny process the rate at which distillation takes place is rigorously determined?—Yes, it is rigorously determined, but I find the personal peculiarity of two assistants is so great that a man who is in the habit of doing his work rapidly has a tendency to distil over the quantity under the time, and the man who is a slow worker has a tendency to take more than the time. That is what I call the personal error of the process.

11491. And that is what I call carelessness?—Very well.

11492. There is no difficulty whatever, after a very limited amount of experience, in a man, having a watch before him, as all these operators have who do this thing, in a man bringing over his 110 cubic centimetres time after time within about two minutes of another. The actual time at which the distillation takes place is limited to half an hour, and perhaps the difference of time will be 28 minutes in one case, 29 minutes in another, and 31 minutes in another, but never greater than that—they will all be one or two minutes round the half-hour. If the man will not work with a watch, and under those conditions, that is not what I call temperament, it is inattention to detail, and he is not strictly conforming to the prescription laid down?—I suggest that a better method is to do away with that necessity, and to distil the whole of the volatile fatty acids. I find that it has this advantage, that I can give the general public something which they fancy they understand. I can tell them that the butter contains so much per cent. of volatile fatty acids, whereas if I tell them that by the Reichert process I obtained a certain number of cubic centimetres, it means that I get a letter to know what it is all about.

11493. You prefer to go on and get over what you call the volatile acids; is that your method?—Yes.

11494. Would you kindly explain to us how you proceed to get over the sum total of the volatile acids which are present in butter?—I proceed exactly as in the Reichert-Wollny method. I do not take over the 110 cubic centimetres to begin with, but 50 or 100, where I wish to compare the results with the Reichert-Wollny figure.

11495. That is, sometimes you take over 50 cubic centimetres and sometimes you take over 100?—Yes. If I want to obtain the Reichert figure I take over 110; if I do not want to obtain that figure I may take over 50 cubic centimetres.

11496. What right have you to assume that in 50 cubic centimetres you obtain what you call the whole of the volatile acids?—I do not.

11497. Will you please explain to us what you do in order to get the whole of the volatile acids?—I add to my distillation flask 50 cubic centimetres of recently-boiled distilled water and continue my distillation.

11498. And you get over a second 50?—Yes, and I go on with that three or four times; as a rule, three times is sufficient, but sometimes four times will be necessary.

11499. What enables you to determine that you have got the whole of the acids?—Because you get no more.

11500. Is it your experience then that there is a limit—that if you successively recharge the flask with water and go on boiling, there comes a point at which nothing comes over?—I do not say "nothing," but practically nothing.

11501. What do you mean by "practically nothing"?—It would take less than a cubic centimetre in decinormal soda to neutralise.

11502. Do you tell the Committee that that is your experience?—Yes.

11503. Have you compared your experience with the experience of any other operators?—No.

11504. If I tell you that no single operator ever reaches any final point in this distillation, but that if he adds time after time quantities of liquid to his flask, he can invariably get the acid over, what have you to say to that?—I think that is highly probable. I proved for my own satisfaction 20 years ago, I should think, the

Mr. F. J. Lloyd.

16 May 1902.

the non-volatile fatty acids are only non-volatile in a certain sense, and that by continuous heating at the temperature of 212 degrees F. they distil or disappear.

11505. Where is the finality in your method?—The rapidity with which the results decrease.

11506. Of course the greater portion goes over, we know, in the first 50 cubic centimetres; in the second 50 c.c. you have a still smaller amount; in the third 50 c.c. you have a still smaller amount again, and so it goes on; it is always coming over, and there is no finality about it at all?—I will give figures actually obtained where four distillates of 50 c.c. were taken over. The first distillate neutralised 12·5 c.c., the second 2·7, the third 1·2, and the fourth 0·4. Surely I was justified in saying that there was no need to proceed further with the distillation?

11507. That is a matter of opinion, and I do not know if you were not; 0·4 is a sensible proportion?—I am afraid when calculated out it means a mere nothing.

11508. In volatile acids, yes; in absolute butyric acid, for example, it does not mean much. This is really where we differ: What do you gain by prolonging this business? Here you are perhaps two hours or three hours in effecting this distillation in successive quantities of 50 c.c. each; what is the practical gain in doing it in that way over a method like the Reichert-Wollny method, which is accomplished, we will say, in 35 minutes, titration and all? What is the substantial gain in it from the point of view of the analyst or in the public interest?—My experience of the method is that it has certain advantages. The first is that there is no necessity to weigh out so absolutely a definite quantity of fat.

11509. There is not the slightest difficulty in weighing out 5 grammes of melted butter-fat?—The second reason is that the variation in butter, *i.e.*, the variation in volatility, is overcome, because you get all the volatile acids off whether they rapidly come over or whether they do not rapidly come over. Your experience with the mixtures which you sent from Somerset House was with mixtures which were absolutely uniform—the same butter and the same adulterant; but can you say that you would obtain always the same results, no matter what was the nature of the butter, and no matter what was the nature of the adulterant?

11510. Do you ask me the question? Because I will tell you that is precisely what we did obtain, for we did not confine ourselves to one butter. We purposely selected butters which themselves had a low Reichert-Wollny number, and which, therefore, had a difference in the proportion of the volatile to non-volatile, acids, and we purposely selected, and we got from various places, butters with a high Reichert-Wollny number to start with. We took various samples of margarine. These analyses were not done on one or two samples alone; we rang the changes on a great variety of butters with different origins, and with different samples of margarine. We also introduced cocoanut oil in the same way I do not know that the whole work could have been more carefully done in that respect, or more comprehensively done?—I am sorry that I do not know those results, because it is wasting the time of the Committee for me to ask for information. I have mentioned the main facts; I find no difficulty in my method. The assistant has not to be too strictly tied to his watch, and it makes very little difference in the end whether he has 50 c.c. over-stepped and 60 c.c. taken off. I get a result which is understood by the public and the farmers, who appeal to me for analysis. Moreover, I think I may say that those results are not unsatisfactory.

11511. Is there any single analyst who in your opinion uses the Reichert process pure and simple as you do to-day? Are you not alone in this suggestion of keeping to a process which Reichert himself employed 25 years ago?—I was not aware that he did distil the whole of them off.

11512. He tried to do so, and it was because of the impossibility of doing it that the whole thing was given up. What you practise is the Reichert process, pure and simple, of 25 years ago, and you stick to it?—Certainly.

11513. Is there any other analyst within your experience who does the same thing?—No. I have never taken the trouble to communicate my work to any society. I have carried out this work because I have found that it gave me the best results, and enabled me to advise my clients better than any other.

11514. Will you take it from me that Reichert himself has given it up?—It may be.

11515. You say that if a standard at all is adopted it should be a high standard. Your object, I presume, in suggesting that is to minimise the chance of sophistication by margarine; is it not so?—Yes.

11516. You appear to be aware that there are occasional samples, or you think there are occasional samples of butter—and you specially instance Siberian butter—which are characterised by giving low Reichert-Wollny numbers, or low numbers for volatile acids, we will put it that way?—Yes.

11517. Is it the fact that Siberian butter is characterised by giving low volatile acid figures?—I cannot speak from experience, as I have not analysed Siberian butter.

11518. How have you got the knowledge that it does, then?—I understood from reading that it gave those low results.

11519. (*Major Cragie.*) From statements in the case that was tried in Court. Statements made by an advocate on one side?—Yes.

11520. (*Professor Thorpe.*) That is all the knowledge you have?—Yes; it was a case in the Thames Police Court; that is what I got my idea from.

11521. And that is all?—Yes, that is all; I have no knowledge of Siberian butter.

11522 Assume it to be the case that Siberian butter is just like any other butter: what have you to say then?—If Siberian butter is of the same composition as ordinary butter then it would come under any ordinary standard which you may fix. I hand in a table showing the results of actual pure butter, tested with great care from February, 1888, to April, 1890 (with only a few months missing) showing the fluctuations (*handing in Table*). I think it only right to say that, perhaps, being 25 years behind the time according to your views, there are analysts who think they could do better as advisers or consulting chemists to the British Dairy Farmers' Association than myself, having always maintained that it was impossible to take minute quantities of margarine and butter.

11523. What do you mean by "minute quantities"?—Five or 10 per cent. of margarine in mixtures of margarine and butter. The society has, on several occasions thought it desirable to test the statements made by other analysts, that they were able to do it, and samples have been prepared somewhat similar to the way in which you prepare samples, and have been sent to these analysts, and generally sent to me as well. I may say that in all cases the result was a failure, as they were not able to detect minute quantities of margarine in the mixtures.

11524. Did these other analysts admit that they were a failure, or is it your judgment that they were a failure?—It was not my judgment; it was the judgment of the Council of the British Dairy Farmers' Association, who in council read the results while the committee reported what was the actual composition of the mixture sent.

11525. What were the reports of the analysts?—The reports of the analysts, as I say, failed to discover what was the proportion of margarine present.

11526. Were they unable to discover that any margarine was there?—I do not say that they were unable to do that; that was not the point, the question was whether they could determine the proportion of margarine in a mixture.

11527. The Committee will be with you there: it might be quite impossible to ascertain the exact proportion—5, 6, 7 or 8 per cent.; but could not the qualitative facts of admixture be ascertained?—I should be doubtful whether they could always.

11528. Did the analysts who were concerned report that they were unable to determine the fact of admixture?—No, because so far as I could remember they were never asked that point. The question put to them was, what is the proportion. They were told practically, "Here is a certain number of samples which we have made up: what is the proportion?"

11529. (*Major Craigie.*) The admixture was taken for granted then?—Yes, it was. In January, 1899, which was the last time that the Council put myself and others under this test, five samples were sent. I reported sample B as containing 15 per cent. of margarine, and, at a subsequent council meeting my results and the report of the committee were presented; the committee reported that they had mixed in that sample 15 per cent. of margarine.

11530. (*Professor Thorpe.*) Will you kindly tell us how you made that deduction that the sample contained 15 per cent. of margarine?—I will in one moment. Sample C I reported as containing 25 per cent., and 25 per cent. had been put in; sample D I reported as containing 20 per cent., and 20 per cent. had been put in. Sample E I reported as a genuine butter, and it was a genuine butter. Sample F I reported as containing 5 per cent., and the quantity actually put in was 10 per cent. You asked me how did I arrive at this conclusion? I analysed those samples by my antiquated method, and I found that E gave normal figures for a genuine butter, which I take to be 6 per cent. of volatile fatty acids; the actual quantity determined in E being 5·98. I take my standard at 6; I have no right to do it perhaps, because in these pure butters they vary from 5-7; but I have always recognised that if I took a standard of 5 I should be nowhere. The majority of butter, according to my experience, certainly reaches six per cent. of volatile fatty acids.

11531. Expressed as what?—As butyric acid; I will refer to that in one minute. By a simple calculation of the proportion of the volatile fatty acids in the other samples, a mere calculation gave me those figures, 15, 25, 20 and 5, three of which were exact, and one of which which was wrong. Unless I had had sample E sent to me, which was a genuine butter, or unless I had known the composition of that butter, if that butter had fluctuated from my standard, of course my results would have been all wrong. That is why I say that it is impossible to determine with certainty the proportion of an admixture. If any standard is taken it must be high, or else you will certainly pass a large number of admixtures which are put on the market—in fact, the manufacturers have actually told me to my face, that they can easily put in 25 per cent., and not trouble about the public analyst discovering it.

11532. You have given the result of your experience rather in corroboration of the validity of your particular method of determining the volatile acids, have you not?—No, I do not say that. I say that that method will give accurate results if the factors are known.

11533. What is the gain? I am afraid you must have consumed an inordinate amount of time in getting at these results, because you could have got at exactly the same results, under the same conditions, by using the quicker and more definite Reichert process; you would have had exactly the same basis of calculation, and the probability is that you would have obtained precisely the same concordance between the actual amounts of margarine present. and what you found—probably you would have even got a more literal agreement than you did; the probability is that the whole would have been right instead of there being one wrong?—I may say that the first distillate was taken off by the Reichert method, only I was working then in those days with $2\frac{1}{2}$ grammes instead of 5 grammes.

11534. Therefore the experimental error would be very much larger?—As a matter of fact, the Reichert results are not so close as the determination of the total volatile fatty acids; but I had not intended mentioning that, only from what you have stated I think it only right to say that the actual Reichert figures would not come so near to the actual quantity of margarine present as the total volatile fatty acids.

11535. Obtained by what process—by washing them out?—By distilling four times.

11536. (*Sir Charles Cameron.*) As I understand, you rely altogether upon determining the total amount of fatty acids?—Yes.

11537. To a certain extent upon the ground that you are dealing then with a tangible quantity?—Yes.

11538. In these specimens that you examined and found the exact quantities of foreign fats that were added purposely, the butter to which the foreign fats were added may have had the minimum amount of fatty acids?—No, it had practically what I call my standard amount, not a minimum amount; it had 6 per cent., and the minimum amount would be 5 per cent.

11539. These butters contained 6 per cent. of volatile fatty acids, you say?—The original butter did.

11540. What is your maximum amount?—I have found in butter 7 per cent. of volatile fatty acids.

Mr.
F. J. Lloyd.

16 May 1902

11541. Supposing, then, in this case that the butter had originally contained 7 per cent. of volatile fatty acids, what would your deductions have been?—My deductions would have been wrong, because I should have assumed that there was less margarine present than there actually was.

11542. Would you have assumed that there was any at all?—Yes.

11543. How would the proportion of 15 per cent. of foreign fats added to a butter containing 7 per cent. lower from the 7 per cent. to the 5 per cent.? It would be 100 + 15 = 115; and if 100 parts contained 7 per cent., the problem is, how much would 115 parts contain?—If the original butter had contained 7 per cent. of volatile fatty acids, the 10 per cent. mixture would not have been determined as a mixture, but the other mixtures would have been determined. It is a somewhat complicated calculation, and I cannot do it here in a minute.

11544. You have been dealing with a butter containing 5 per cent. of volatile acids, 15 per cent. of foreign fats being added, how would it be in the case of a butter containing a minimum proportion of volatile fatty acids, namely, 4 per cent.?—Of course that would have been reported on as containing a larger amount of foreign fats than was actually present.

11545. Those results appear to be obtained by very much the same process as they would have been by the Wollny process: though it is an empirical process, it is based upon the percentage of volatile acids in the fats, which are distilled over during a certain period, and at a certain temperature?—Yes.

11546. Some of the higher boiling point fats, like myristic acid, are not probably altogether going over?—Quite so.

11547. Do you ensure in your process that the myristic acid does go over?—I could not say, as I have not actually proved that. I think there can be no doubt that by my process you do practically get all the volatile fats over. One of the principal reasons why I am wedded to my process is that the volatility of the fats in the butter appears to me to vary so greatly in different butters—the proportion is not always the same. In some butters you get a larger proportion of a fatty acid which is volatilised or distilled with difficulty.

11548. You mean that the proportions of the different fats, the butyrin, the caproine, and so on, vary, and therefore the boiling points of their acids vary?—Yes. My opinion is, that by rigid distillation for a definite time, you do not overcome these variations in natural butter.

11549. And that you must subject the sample to the same process as you would if you were making an experiment upon what you knew to be pure butter; butter which you saw made yourself for the purpose of determining the amount of the fatty acids?—Yes.

11550. And by its falling below your 5 per cent. you estimate the quantity of foreign fat present?—Yes.

11551. (*Mr. Gibbons.*) You say you have found a difficulty in in determining the presence of 25 per cent. of margarine in butter; what would be the lowest admixture of margarine with butter at which that difficulty would cease?—It depends so much upon the nature of the margarine that is put in, and on the butter with which the margarine is mixed. If you take a margarine with a high proportion of volatile fatty acids, and a butter with a high proportion of volatile fatty acids, then you might have 50 per cent. of margarine and not be able to report 25.

11552. I will take the ordinary marketable margarine as being mixed with an average pure butter; then what would be the amount of admixture at which you would find no difficulty in determining the presence of margarine in that butter?—I think you can estimate 15 per cent. under those conditions.

11553. In your *précis* I observe you say that you have found a difficulty with a butter in which there was even 25 per cent. of margarine?—Yes, because those mixtures were made specially, if I may say so, to prevent the analyst detecting them.

11554. (*Major Craigie.*) They were intended to puzzle the analyst?—Yes, they were intended to be sold as butter and to pass the test of public analysts, and they were skilfully prepared with that object.

11555. (*Mr. Hickey.*) What is the highest percentage of fatty acids that you have ever found in pure mar-

Mr. F. J. Lloyd.

16 May 1902.

garine?—I am sorry to say that I cannot tell you that, but I have found over 2 per cent. I have not got the figures of the highest that I have found. I never thought of looking those up.

11556. What is the lowest percentage of volatile fatty acids that you have found in butter?—I have found as low as 4·9, and I have one instance of 4·76; but I think that was a very doubtful sample, although the non-volatile fatty acids rather agreed. At any rate, that was an exceptional instance, and I take it that, as a rule, you may say that 5 per cent. is the lowest in genuine butter.

11557. You say that if you mix a high-class margarine with butter containing a large percentage of volatile fatty acids you could incorporate foreign fat to the extent of 25 per cent. and still deceive the analyst?—You could deceive the analyst so far as not being able to state the proportion present, but not so far as being unable, perhaps, to detect that there was a foreign fat present.

11558. If the analyst who got such a sample were a public analyst, would he give a certificate, in a case of that kind, that the butter was adulterated?—I am not a public analyst, and I do not know what he would do under the circumstances—it is a difficult point.

11559. At the commencement of your evidence you gave the Committee to understand that the societies you represent were in favour of a standard of 16 per cent. for water in butter, and that they disapproved of what they thought was a recommendation of this Commitee that butter containing more than 16 per cent. could be sold if the fact were disclosed?—Yes.

11560. Have you had a very considerable experience in the manufacture of butter?—No.

11561. Have you not been connected with several dairy societies?—Yes, I am, but then I cannot say that that gives me experience in the manufacture of butter.

11562. Have you analysed the butters of those societies, believeing that they were honestly made?—Yes, a great number of samples.

11563. Can you tell the Committee how the percentages of water in such butters varied?—I have known genuine butters to go up to 18 per cent. of water. Those samples that go above 16 per cent. would be quite exceptional ones, and the great majority of the samples fall below 16 per cent.

11564. What reason could you ascribe for any of them going above 16?—I cannot say, because I did not inquire about the particular samples in which I found the water to go above 16 per cent. I had intended to do so; but I heard that this was too late for me to give evidence before the Committee on that point, so I did no write for the information. Undoubtedly the method of manufacture is the great thing.

11565. If you were giving evidence before this Committee prior to the fixing of any limits, would you have recommended one limit, or would you have recommended two; that is, one limit for fresh or lightly salted butter, and one for heavily salted butter?—I may say that the Committee have fixed the limit which I should have asked them to fix—16 per cent. was in my mind as the right limit to fix, with no fluctuation.

11566. Have you found, in your experience, a larger percentage of water in salt butter than in fresh butter?—I have not; but then my experience has been very slight with salt butters, and slighter still with Irish butter.

11567. As an analyst, what would you expect in that way; would you expect that salt butter would contain more water than fresh butter, or less?—I should not consider that the salt would have and definite action over and above the method of manipulation.

11568. You gave evidence before the Food Products Committee in 1896, did you not?—Yes, I think I did.

11569. Did you not on that occasion recommend the adoption for two standards for water in butter?—Not that I know of. If I did, it was at the request of some society; but I do not think I did.

11570. In your *precis* you say that if it could be proved that Siberian butter, for example, was of an abnormal character, and coud not conform to any standard that might be set up, you would make it compulsory that such butter should be labelled. Do you recommend that?—Yes, any butter which is abnormal ought to be sold as such, so as to escape prosecution as margarine, or as mixture.

11571. Do you support or endorse the opinions of the societies which you represent, in the view that they have taken condemning the principle of disclosure with regard to what we might call excess water in butter?—Yes.

11572. Then, why would you allow it in the case of Siberian butter if the chemical composition of it be proved to be abnormal. You say, in your *précis* that you would label it?—I would sell it as Siberian butter because in England butter is sold simply as butter, and you do not know where it comes from, or of what nature it is; but if you buy a cigar you want to know where it comes from. I think that if butter of abnormal composition is put on the market it should be so labelled as that its quality might be known.

11573. Assuming that it was of an abnormal character and was labelled, would you permit its sale?—Yes.

11574. Is that not the same principle as is embodied in the Act of 1875 with reference to the percentage of water in butter?—No, because here I am speaking of a genuine article, and not of a sophisticated article. In the case of water in butter you are admitting of a sophisticated article. It is not to cover the genuine article that you allow this percentage.

11575. Have you not found a great amount of variability in the percentages of water in the butters of different countries, made under different conditions, and made for different purposes?—Yes, but that is not so important as the fact that butter containing 40 per cent. of water can be made direct from milk; the water is not added at all, but the butter is actually made with 40 per cent. of water in it, and it is a genuine butter. If you once admit butter with more than 16 per cent. of water you must admit that substance.

11576. Did you ever come across a case of butter containging 40 per cent. of water?—Yes; a machine was sold, in Austria, I believe, for £1,000, and when the butter made by it was analysed it was discovered to contain over 20 per cent. of water, and the buyer repudiated the purchase. He took the written opinion of Fleischmann in Germany, of Duclaux in Paris, and of myself in London, and quashed the purchase. Subsequently, a machine was introduced into England to manufacture butter direct from milk, and the manufacturers and people interested came to me to discover the nature of the butter. I had, not one merely, but dozens of samples of butter as it came from that machine. I found that it contained over 40 per cent. of water in some cases, nearly always over 30 per cent.; and yet I never had a practical man in my laboratory who estimated the water at over 12 per cent.

11577. That is, judging by the physical appearance of the butter?—Yes; that butter could be put on the market to-day, and would look drier and better than the majority of English butters, containing under 16 per cent. I do not think an inspector would take a sample of it, he would never dream of it.

11578. Was that machine adopted?—No, I condemned it absolutely, and the thing was dropped; but if a loophole is to be given to people to put in any quantity of water, that machine will soon come to the front. There is no doubt about that.

11579. (*Major Craigie.*) What do you mean by a loophole?—If they are allowed to sell butter with a percentage of water over 16.

11580. You mean that there is something now to be done to give manufactures of genuine butter that which they have not now got?—Yes.

11581. Has any such proposal ever been made?—I take it that that is the outcome of the letter into-day "Times" from Mr. Plunkett; unless that is overcome that will be the practical result unless, of course, the Government moves in the matter. If Mr. Plunkett is right in his argument, there ought to be something brought into Parliament at once to alter the condition absolutely.

11582. Your suggestion is that there should be an alteration of the law?—Yes. If it is the law it must be altered immediately.

11583. (*Mr. Dunn.*) I understood you to say that there was 40 per cent. of water in the butter; but I did not quite understand whether no one in your laboratory could tell that it contained more than 12

Mr. F. J. Lloyd.

16 May 1902.

per cent.?—No practical butter expert, by looking at it, cutting it and examining it in the ordinary way would have said that it contained more than 12 per cent.

11584. It would be quite easy to discover, of course, by evaporation?—Yes, you could determined it chemically.

11585. (*Mr. Gilchrist.*) Why did not this machine for producing from milk butter containing such large pro-proportions of water find any favour; did the butter not sell, or was the machine condemned?—I condemned the machine as producing an adulterated article, which could not be put on the market.

11586. Was it illegal to put that butter on the market?—In my opinion it was illegal to put any such butter on the market, and I take it that that has been the basis of all prosecutions in the past for water in butter.

11587. Are you in favour of a standard being fixed for the soluble acids in butter?—That is a most difficult question. I am rather opposed to the fixing of public standards altogether, but I do not see how they can be avoided. My view would be that it would be very much better for all purely chemical questions to be fixed by the chemists, who have the carrying out of the Act, and not to be publicly fixed. If the analysts of the country are to be guided by a fixed standard proposed by this Committee, it is perfectly evident that anyone who wishes to put a fraudulent substance on the market will have the same knowledge as the public analyst, and will know how to overcome and get round it. I certainly will not express an opinion whether it is desirable that there should be a standard; but I do say this: If you fix any standard, let it be a high standard so as to prohibit wholesale adulteration, because if it is a low standard it appears to me that the outcome must be the wholesale adulteration of butter.

11588. Are you in favour of a standard?—No, not of a public standard.

11589. Shall I say you are in favour of no standard, but would leave things as they are at present practically?—No, certainly not. My view has always been, and was originally, that there should be a Court of Reference appointed by the Government, consisting of experts capable of deciding what should be the standard to guide the public analyst. I should never have allowed those standards to be made public property, because I take it that in carrying out the Act you are almost like professional policemen—your endeavour is to suppress fraud; but if you allow those who wish to be fraudulent to know exactly the point to which they can go, they certainly will defeat the object you have in view of putting down fraud. I am, therefore, not in favour of standards which are made public.

11590. (*Professor Thorpe.*) Nevertheless you are in favour of some direction being given to the experts with a view to enabling them to form an opinion?—Yes, certainly.

11591. So you are really in favour of limits—or standards, as we have called them—being fixed by some authority, but your point is that those standards should not be made public?—Yes.

11592. (*Mr. Dunn.*) You are in favour of a hidden standard?—No, of a professional standard to be used amongst professional men.

11593. (*Professor Thomson.*) Known to the public analysts?—Yes.

11594. (*Mr. Gilchrist.*) Can you easily translate a Reichert-Wollny number into the volatile fatty acids? Suppose you have a butter containing 5 per cent. of volatile fatty acids, can you easily tell us what that would be equal to in the Reichert-Wollny number?—Yes; but you cannot translate the Reichert-Wollny number into the total volatile fatty acids, because it only represents a portion of the fatty acids.

11595. Then you can translate the volatile acids into a Reichert-Wollny number, but you cannot translate the Reichert-Wollny number into the volatile fatty acids?—No; you can translate your Reichert number into a certain proportion of volatile fatty acids, but it does not represent the whole of the volatile fatty acids, and you cannot take the whole and translate them back into the Reichert number.

11596. You are often consulted by farmers and others having cattle, with regard to giving them assistance in the production of their butter, as I know. Supposing a standard were adopted, and a farmer in England found that his butter was not up to the standard, and still it was genuine butter, could you, as a consulting chemist, give him advice which would enable him to bring that butter up to the standard by the treatment, the housing, or the feeding of the cows?—No.

11597. (*Mr. Hickey.*) You said just now that you did not remember when you gave evidence before the Food Products Committee that you recommended two standards of water for butter, one for fresh and the other for salt butter?—No, I do not remember that.

11598. At Questions 285 in the report of that inquiry you were asked, "Do you propose a standard in regard to that?" and you answer, "I propose that there should be a standard for fresh butter and a standard for salt butter. I think there should be a difference between them. Inasmuch as, up to the present time there has been no limit at all fixed, the standard should, to begin with, not be too severe; and I would suggest between 15 and 16 per cent.; either the lower or the higher of those two figures for fresh butter, and 16 to 18 per cent. for salt butter, judging, of course, from experience of others besides myself, and the Committee will decide on that." Then at Question 532 you were asked, "Is it in your experience that salt butter loses its water much more rapidly than fresh butter?" and you answer, "Yes, that would naturally follow, I think." The next questions and answers are: "(Q.) That being so, why do you suggest that the standard should be higher?—(A.) Because the presence of the salt would retain in the butter a certain amount of moisture, which in fresh butter would not be retained. (Q.) In spite of it losing its water, naturally it would be predisposed, notwithstanding that, to hold a greater percentage of water permanently than fresh butter?—(A.) Yes"?—I do not withdraw anything that I stated there, but I believe that at that time it was the general proposition of the societies whom I represent that there should be a higher standard allowed for the salt butter, and I was supporting that view simply on the facts I was aware of.

11598*. (*Major Craigie.*) I presume that we may take it from you now that that is not the view which you hold at the present time, nor isit the view of the societies which you represent to-day?—That is so.

11599. They are satisfied with the present standard of 16 per cent.?—Yes.

11600. (*Mr. Hickey.*) Has anything occurred since you gave that evidence which has caused you to alter your view on this point, or which has caused the societies to alter their view?—I think it has been due to the fact of an attempt to make salt butter hold an excess of water.

11601. Is that the result of actual knowledge or is it mere speculation?—That I cannot say. I am speaking of the general feeling of the societies.

11602. Is it founded on any actual knowledge that that is so; is it the result of any experiments which have been made either by yourself or by your societies since 1896?—It is not founded upon any experiments made by myself—I think it is founded on general——

11603. Surmise?—You might say surmise of you like, or general opinion.

Mr. Charles Estcourt, F.I.C., called; and Examined.

Mr. C. Estcourt.

11604. (*Major Craigie.*) You are a Fellow of the Chemical Society, a Fellow of the Institute of Chemistry, and one of the founders of the Society of Public Analysts?—Yes.

11605. I believe you have been Public Analyst for Manchester for 29 years?—Yes.

11606. For more than 20 years the administration of the Food and Drugs Act has been carried out by a Committee of that Corporation?—That is so.

11607. You have given advice to that committee?—I have.

11608. You are also Public Analyst for the Borough

Mr. C Estcourt.

16 May 1902.

of Bacup, for Macclesfield, Ashton-under-Lyne, and Lancaster?—Yes.

11609. I understand you are attending here to-day at the request of the Manchester Corporation?—Yes; after their having desired that a deputation should wait upon you, which you found was not convenient.

11610. The Manchester Corporation received a request that they might send up any evidence that they wanted to lay before this Committee, and you are here in pursuance of that request?—I am.

11611. I think the Corporation of Manchester have given a good deal of attention to the question of butter standards for the last eight years—since 1894?—They have made representations in connection with butter standards during that period.

11612. I assume that they have given a great deal of attention to it, because we have before us at the Board of Agriculture and here a series of resolutions on the matter. Do you wish to lay before this Committee any particular suggestion as to the nature of a standard, if any, which should be recommended under Section 4 of the Act of 1899?—I think I should be disposed to take the standard that has so long governed the whole of the analysts of the country—that is, the standard of 4·5 for the soluble fatty acids.

11613. Do you propose one single standard or several tests?—I should call it a limit; let there be as many tests as you like, but that should be the main test, the standard one. The other tests dealing with the volatile acids are more or less arbitrary.

11614. Before going further into this point, perhaps you will allow me to put to you this general question: In virtue of the opinions held in the different Lancashire boroughs which you represent, and of your own practical experience, are you in favour of there being some standard fixed by a Regulation under the Act of 1899?—Yes.

11615. You do not want matters to remain as they are?—I do not.

11616. Have you read the Interim Report of this Committee on the standard for water in butter; and have you seen the Regulation which came into force yesterday, fixing a standard of 16 per cent. of water as raising a presumption that butter was not genuine?—Yes.

11617. Do you agree with that?—I do.

11618. You further recommend to the Committee the adoption of another standard relating to the amount of soluble fatty acids in butter?—I do.

11619. Do you think that would facilitate the protection of the public and the conviction for fraudulent sales to the public?—I do. The only grievance we have had as public analysts, I may say, speaking for myself in Lancashire, has been the fact that there was no standard. We have had no ground of complaint against Somerset House as it was or the present laboratory. We simply complain of the fact that there is no official standard.

11620. Do you think there would be any harm in such a standard as you propose being made known to the public, and therefore at the command of adulterators as well as honest persons?—I am afraid they know enough already.

11621. You see no harm likely to happen from promulgating a definite standard?—None whatever.

11622. You are, of course, aware that the effect of a standard under Section 4 is only to raise a presumption which the accused person may rebut by evidence in court?—Quite so.

11623. Such a standard would not, of course, fix the composition of butter?—No. I daresay you may have observed that Dr. van Rijn states that in Belgium they have formulated a law to deal with the question. They do not say in Belgium, "This is not butter"; but they in effect say, "You shall not sell it of this quality as butter." So in the case of milk, you have not said: "This is not milk"; but you have said, "You must not sell it of this quality unless you prove that it comes from the cow."

11624. There is no such Regulation as regards milk; the Regulation as regards milk is that in the case of a person being accused of selling milk not in conformity with the Food and Drugs Acts, the onus of proof shall be thrown upon him to show that that milk is genuine where less than 3 per cent. of fat is found in the milk; he is not prohibited from selling it, only the onus of furnishing such proof is thrown upon him?—May I point out that in point of fact he is; because I think there was a case decided a month or two ago in which the judge held that defective arrangements with respect to milk or cows, which would affect the milk, brought the vendors within the section, and that a plea of defective arrangements could not be accepted as establishing that the milk was produced naturally in a case of negligence, or of ill-treatment, or of ill-feeding. I suggest that that is much on all fours with the butter question. The only question that these gentlemen raised in Holland (and I believe it is raised in Sweden also) is that something has a peculiar effect at some part of the year upon the volatile fatty acids. Van Rijn inquires what the reason is, and he is quite satisfied that he has discovered the reason. That fact became known to the Dutch farmers some time ago (because these experiments were done in 1897 and 1898), and should have led to their dealing differently with their cows at that particular time of the year.

11625. Have you dealt yourself with the analysis of Dutch butters?—I must have had a large number of Dutch butters pass through my hands.

11626. Do you agree with Van Rijn?—I have to accept his explanation as to the cause, because I think he verified that. But I go further and say that although that was the case in 1897, that state of things need not exist now. If stabling cows in the north of Holland for two months in the year would produce a normal condition of the volatile fatty acids, then, I think, they ought to stable them, and we ought not to be saddled with this inferior butter.

11627. Are you now proposing a general standard to be recommended to the Board of Agriculture?—I am.

11628. You do not propose that any exception should be made for the butter coming from any particular country?—I do not. I think Dr. van Rijn says they are making such an alteration of the law as will keep that butter in Holland and prevent it from being sent abroad. I think he says in his book that they ought to consume that inferior butter in Holland. "The societies of butter and cheese makers," he says, "exert all their power to furnish severe control, absolutely guaranteeing genuineness; and means are under deliberation to prevent butter of abnormal composition being introduced into the trade."

11629. *(Professor Thorpe.)* What you have just now referred to is the case which was decided on appeal, and which will, I suppose, be hereafter known as the "Clacton case," is it not?—Yes.

11630. In that case the Lord Chief Justice and one of his coadjutors were of opinion that although it had been conclusively demonstrated that a certain sample of milk was the genuine product of the cow, inasmuch as it had a very large and notable diminution of the amount of fat, that really was not a valid defence?—I understood that to be so.

11631. It was not milk: it was not of the nature, substance, and quality demanded by the purchaser?—That is it.

11632. You contention is that, strictly speaking, the same sort of supervision ought to apply to butter?—That is so.

11633. What the purchaser has a right to expect is not alone the genuine product of the cow or of the milk-fat of the cow, but a product which conforms more nearly to the average composition of butter?—Yes, although rather remote even from the average.

11634. That the abnormal butter which he has sold is the genuine product of a cow is not a sufficient defence?—That is so. Plainly the cow is an animal which is affected largely by the art of man. Man stables her, man feeds her, man alters the natural composition of the milk from the cow, in fact; and if he does that he should certainly be prevented from neglecting a part of his duty when it ends in a compound being produced which is so abnormal that it may be imitated very readily in this country, and with very great advantage.

11635. I gather that, speaking as a public analyst, from the point of view of a sanitary authority which controls the sale of food or to some extent supervises the sale of food in your city, you recommend to this Committee that as regards butter certain standards or limits should be laid down upon which the criterion of its quality should be based?—That is my opinion.

11636. You have suggested to the Committee that a determination of the soluble fatty acids, I think it was, of the butter should be taken as a criterion?—Yes.

11637. Do you suggest that generally, or do you mean that any process which could be shown to be a valid process and not liable to misconception and reasonably easy of application should be taken as the measure of the purity of the butter?—I am of that opinion.

11638. Let us be quite clear about this; you are not wedded to any particular mode of determining the soluble fatty acids?—I am not, although I have adopted the one which was described in print in 1883.

11639. That was in Dr. Bell's book?—Yes.

11640. Have you any experience of any of the newer methods of determining the equivalent of the soluble or volatile fatty acids?—There is the distillation process which is not perhaps an absolute equivalent. I use that process always for sorting out butters; that is the first method that I apply.

11641. Do you use the Reichert-Wollny process?—I use the Reichert process, employing 2½ grammes only.

11642. You have not hitherto adopted the Reichert-Wollny then?—I have done it in that way. It takes a considerable while if you use 5 grammes. When I use the 2½ grammes I adopt in practice all the other parts of the process; that is, I saponify with glycerine and soda; I have the distilling apparatus all of the same dimensions; I use it always in the same way. I distil off the same amount, and I have the same size of flame, so that I can compare those methods. My first process would be the examination of the butter for water, which is part of the melting operation. I get the fat from that, saponify, etc., and then estimate by distillation. That is a means of sorting out; and if it gives a good result you scarcely need go any farther.

11643. You are aware, I suppose, of the action of the Committee of the Society of Public Analysts in connection with the method of assessing the amount of butter-fat in margarine?—Yes, I have the apparatus made up exactly as designed there.

11644. Then you have read the report, and no doubt you are familiar with the details of the method which was then laid down?—That is so.

11645. Have you any experience of the determination of the amount of butter-fat in margarine by that method?—Yes.

11646. From your experience, would you see any insuperable difficulty in the extension of that process to the determination of the amount of volatile acids in butter?—None whatever—that is, as a second test.

11647. You would not put that first?—No.

11648. Do you put the direct determination of the soluble fatty acids first?—Yes; it is an actual absolute determination of the soluble fatty acids.

11649. That, of course, is an operation which takes some considerable time and demands fairly large quantities of washing water?—Quite so.

11650. It is a method which is very largely affected by the skill of the operator, is it not?—Of course, that must apply to almost all the operations.

11651. There are methods and methods, are there not?—Quite so.

11652. The direct determination of the soluble fatty acids is, you must admit, one of the most tedious of the processes connected with butter analysis?—I quite agree with that.

11653. Of all the processes it consumes the largest amount of time?—It does, and requires the most attention, probably.

11654. It consumes that amount of time and requires that amount of attention to some extent, because of the large volumes of washing water which are required?—That is so.

11655. And it has to be hot water, or water of a moderately high temperature?—Yes.

11656. Are not those rather considerable sources of error; I mean are not those very circumstances liable to cause two operators to differ?—To some extent; there is no doubt of that.

Mr. C. Estcourt.

16 May 1902.

11657. Is there any process of butter analysis in which they are so likely to differ as this?—I cannot say that I recognise any.

11658. The question I put to you is, of all the methods of butter analysis, is not this direct determination of the soluble fatty acids the one which analysts are most liable to differ upon?—That may be, but at present there is no other method.

11659. Would you kindly answer the question?—I should rather say that the only method which determines the soluble fatty acids completely is a very difficult one.

11660. And is therefore liable to give discordant results in the hands of individual operators?—Not to a very large extent, one might say. I think I have agreed with your department over one or two.

11661. I suppose two operators could determine the specific gravity of butter fat with an extraordinary degree of unanimity, could they not?—They ought to do so.

11662. And they could determine the amount of water in butter with very considerable unanimity?—They could differ on that, and considerably, I am afraid.

11663. Why should they differ considerably?—Simply because there is no method laid down. The method adopted about which evidence was given in 1894 was to take a large quantity of butter, which we thought was the better way of getting a fair average—500 or 600 grains—and heating it over a naked flame till it crackled and the water was all expelled, and weighing it till it ceased to lose weight. But the gentlemen who represented the Irish butter interest at that time said that was the wrong way, and we would get some of the butter spurting away, which probably we should call water. I have myself adopted a flat glass vessel, and upon that I place a film of butter, which might be 5 grammes or 100 grains, or whatever it is, and I keep on drying it until I get a constant weight. If you use 100 grains only, then in order to get a fair average over a large quantity of butter, you must do it three or four times over.

11664. You mean that your sample must be so arranged?—You must repeat that operation four or five times on different portions of your sample, whereas with 500 grains you can, I think, do it in the most accurate way at once.

11665. What does the point you are raising now mean in effect? It does not mean that the determination of water presents any difficulty; it really means that difficulties arise very largely from the difficulty of selecting a representative sample?—Not quite; the spurting is another thing.

11666. That is clumsy manipulation?—That is so, but it is an effect that may occur.

11667. I think you must admit that of all the methods of butter analysis with which you are familiar, the direct determination of the soluble acids in the way you have described, is the most tedious, takes the longest time, and is liable to a certain amount of error?—Yes, that is admitted.

11668. If, therefore, this Committee were to suggest that an official limit should be laid down, based upon a method which would itself become *ipso facto* official, it is obviously desirable that the method should be such that different analysts would get as nearly as possible exactly identical results?—That is so.

11669. It should be a condition of any official method, I presume, that it should depend as little as possible upon the expertness or efficiency or personal qualities of the operator, and that it should be as far as possible independent of those considerations?—That is so, if you can devise one.

11670. I am rather working up to what would be the ideal conditions to be laid down for such a method. You state that you are of opinion that inasmuch as Dr. van Rijn's results must now be known in Holland, they must have been promulgated throughout the length and breadth of Friesland, and it is a fair assumption to make that they have ceased producing this abnormal butter?—I should take it to be so.

11671. What evidence have you that they have in any way altered their procedure?—None whatever; but then we have no evidence of adulteration—it is only an inference; in fact, all our work is an inference.

Mr. C. Estcourt.

—

16 May 1902.

11672. What you tell us in your précis is that it is but fair to infer that they have ceased to produce abnormal butter?—This gentleman is employed by the Dutch Government to do certain work, which he does. He makes his report to the Government. It is for the purpose of determining what causes this abnormal condition of Dutch butter. It was reported some time ago—the latest analysis, I think, is dated 1897—one may presume, therefore, that the farmers in Holland have been made acquainted with it by the Government. I have no means of getting that information myself, but I think it is a fair inference.

11673. (*Major Craigie.*) Is it your experience that farmers always do what they are recommended?—No.

11674. (*Professor Thorpe.*) Let us be quite clear about this, because I think I see what you are leading up to. When you get a low sample of Dutch butter now, do you say the presumption is that it is adulterated?—That is so, in my mind.

11675. But you have no valid evidence to show that a Friesland farmer is now stabling his beasts at an earlier period of the year than he did formerly?—I have none whatever.

11676. Or that he is feeding them differently?—I have none whatever. I have the inference here which I give you, and I say it is a fair one.

11677. It is an inference, and the value of it is a matter which I think you yourself must determine. I do not know that anyone else would draw such an inference as you have?—I had to form some judgment upon a certain sample of butter which was produced to me. If I had known of this book at the time, which I did not, I should have said that I was quite justified by this alone in certifying that it was adulterated. We have no knowledge whatever when we examine a sample that it is adulterated, and we have nothing but inference to go upon. We do not see a man watering the milk of his cows; we do not see a man putting margarine into his butter. We see nothing of all this done, and it is all inference; and I say it is a fair inference where a Government has taken the trouble to cause an examination like this, to think that they intend to make use of it. What use can they make of it, except, as Dr. Van Rijn says, to take care that the abnormal butter shall cease to exist if possible?

11678. To show how utterly wrong you are in your surmise, the Dutch Government sent these gentlemen over to lay before us these facts, so that these butters might be accepted by reason of the very circumstances that they had found out. That shows you that they have really not put their house in order at all, and that apparently they do not intend to make any difference. They merely say, "We have been making this butter for time untold under these conditions; you must please in all future time take cognisance of those conditions, and not judge our butters by a kind of ideal standard; you must have regard to the actual practical conditions under which this butter has to be made." That was their contention?—That may be so, and that may appeal to them. If so, let them use the butter. It is apparently the fact that these butters cannot get into Belgium, at any rate, whether it is wrong or right.

11679. That is quite another matter. I am with you, if it is your contention that steps ought to be taken to prevent this abnormal butter from jeopardising the position; we cannot, so to say, give away the whole case because now and again we have a sample of Friesland or some other butter showing an abnormal Reichert-Wollny number. If that is your contention I am with you there?—Thank you, that is all.

11680. But that is rather a different point of view, is it not?—That may be so, but I am here as an analyst, and I put it to you that if I, as an analyst, with no knowledge of what Van Rijn or the Dutch Government had said, meet with a sample of butter and find it comes below 4·5 in soluble fatty acids, I should then consider myself justified in thinking it was adulterated?

11681. You would consider yourself justified, not in condemning it out and out as adulterated butter, but in raising the presumption that it was not right?—I should say that according to such and such a standard it contained so much.

11632. You would raise the presumption that it is not a valid butter, and call upon the person vending that butter to prove, if he can, that it is genuine—that is all you can do?—That is the point. Under the new phase of your decisions with respect to water, and with respect to milk fats, that is what I have no doubt is the proper suggestion; but until those decisions, we had nothing of that sort before our minds—we had simply a point of this sort, that for twenty years or more we had never met with samples of so low a quality except in perhaps three or four instances.

11683. (*Sir Charles Cameron.*) You are in favour of fixing a standard, I take it?—I am in favour of fixing a standard for all foods, drinks, and drugs.

11684. For everything?—Undoubtedly. The only difficulty is that two analysts disagree, not very often in the analysis, but in the inference. We always fight over inferences. If Somerset House or the Government laboratory sends us a certificate contravening our analysis, they do it in a way which shows not that we are wrong in the analysis, but that our inference is wrong. We want to do away with that. If we all had a like standard we should all draw a like inference, and we should all be on the same footing.

11685. It is very desirable I am sure you will agree with me to have some processes by which there is likely to be uniformity of results from different analysts?—I suggest that very strongly. In the case of milk you have already given us a limit; and we should have had a process as well. With respect to the water in butter, simple as that is, why cannot we have a process? Professor Thorpe may recollect the arsenic question. I have had an exceptionally unfortunate time in Manchester during the last month. A method adopted by someone was shown to discover the 35th part of a grain of arsenic in beer, and there was nearly a scare in Manchester; whereas by my process I found nothing. The Officer of Health had a case of what he considered arsenical poisoning, and he obtained beers from the houses the man had been in the habit of attending. These beers he sent to Owens College, and the gentleman at Owens College made a most alarming report of the 35th, the 45th, and the 65th of a grain per gallon in these beers. I had them analysed, and for a fortnight I tried to find it out, but failed. I was at my wits' end. I then sent a sample to Mr. Thomson, whom you know very well, and I visited Owens College, and saw the process, and saw the samples. I got from the gentleman there portions of his samples, analysed them, and could find practically no arsenic in them. Then I went and obtained another sample, which I took personally to Mr. Thomson, and he found no arsenic. In one case I found the 250th part of a grain, and I have now reported those beers to the Corporation as being pure with the exception of that trace of arsenic. In the analyses at Owens College they used that extraordinary process of Reinsch instead of that of Marsh, which we are all using now.

11685*. With regard to apparently so simple a matter as the determination of water in butter, would it not be desirable to have a fixed method?—I think you and I were in the celebrated Manchester case, where there was a considerable discrepancy of opinion expressed by analysts with regard to the amount of water in butter, the difference being as much as two per cent., I think?—Yes.

11686. Even with regard to the determination of water in butter, it would be desirable to state what quantity should be taken in the method by which the analysis would be effected?—Yes.

11687. What is the standard that you think ought to be adopted with regard to foreign fats in butter?—I am in favour of a standard of 4·5 for the soluble fatty acids, or some constant like that being adopted?

11688. What process do you approve of?—The common or ordinary one.

11689. The Reichert-Wollny process do you mean?—No, I am speaking now of the actual estimation of the soluble fatty acids. That is the process I adopt in addition to the Reichert process. I adopt both processes.

11690. Do you find concordant results?—Yes, fairly. If you were to attempt to get the whole of the volatile fatty acids it would be quite as tedious a process as the other.

11691. If you have found concordant results why adopt the two methods, unless you do not mind whether you take a long time or not?—I should take the whole of the methods in view of this point—however able you may be at the present moment to cope with the present adulteration, you have the future adulteration to look to, and there may be such an adulteration as will give you by one method the proper normal amount, but which may be detected by the other method.

11692. I do not think you have rightly understood my question: you say you have always found concordant results?—Yes.

11693. If that is universally and invariably the case, why put the poor analyst to the trouble of carrying out two of these processes, if they are always identical as regards results?—I am only putting it to you that I do that where I find by the volatile fatty acids that it is of poor quality. I do not do it with every sample.

11694. That is, you only use the two processes when you find it unmistakably bad?—Yes.

11695. When you find an undoubtedly adulterated sample, that there can be no question about, you would adopt the two processes?—I should then do everything—I should apply the gravity test as well.

11696. Would you adopt both processes where under the name of butter pure margarine was sold?—No, not necessarily then; I should not require it.

11697. And if you got a butter which was unmistakably butter you would not adopt the two processes?—No.

11698. Which of those two processes do you take the most time on?—The one I adopt now is the volatile distillation. That is the shortest one.

11699. That is the Reichert-Wollny?—Yes.

11700. Do you adopt it in the majority of cases or do you adopt it in every case?—I should say in all cases.

11701. Occasionally, in order to confirm the results you obtain by that process you determine the soluble fatty acids?—If the volatile acids were suspiciously low I should.

11702. How is the determination of the soluble fatty acids effected—by washing out or by exhaustive distillation?—By washing out and titration.

11703. Do you then determine the insoluble portion?—You can determine the insoluble by another process if you choose, but you would not try to do them both in the same operation.

11704. You do not think it is necessary to determine the insoluble?—I do not do it usually.

11705. Do you find the time expended in washing out by the soluble acids process much longer than by the other process?—Yes, undoubtedly.

11706. How much?—I should think it is twice or three times as long. In the ordinary determination of the volatile fatty acids you can do the saponification perhaps in 20 minutes; you can do the distillation in 30 minutes, and probably the entire process can be carried out in an hour and a-half.

11707. In your experience in dealing with doubtful cases have you ever been quite satisfied with your results by one of these processes, and not with your results by the other process—that is have you ever had any conflict between them?—No, I cannot say that I have. I recollect a case of a sample of adulterated Irish butter, and probably you remember it too. At that period we had not got the distillation process, so we had to depend upon the specific gravity and the soluble fatty acids. I used at that time to determine the specific gravity as a sorting process.

11708. If you were only going to adopt one of these two processes, which would you adopt: Reichert-Wollny or the washing-out?—Granted that you have all the appliances as you have in the case of the margarine apparatus, the size of flame, the length of time, and so on, I should think that probably the distillation process would be best.

11709. That is what you would select?—Yes.

11710. Supposing you adopt that process in determining as to the purity of the specimen, what figure would you take on the Reichert-Wollny scale?—If I were using $2\frac{1}{2}$ grammes I should take 12 as the figure.

11711. If you got a smaller figure, say 11, would you pass the sample?—I have had a few samples presented to me from Ireland privately, where I found 11 only. I reported that butter, and it was used in confectionery-making.

11712. What was your report on it?—I reported it as being a suspicious butter.

11713. Only doubtful?—Quite so.

11714. You did not give a certificate upon which a prosecution could be based?—I dare not go into court with such a case as that.

Mr.
C. Estcourt.

16 May 1902.

11715. Suppose you found a sample which gave the figure 10?—I have gone into court on 10.

11716. Then you draw the line at 10?—I draw the line of going into court there.

11717. Even when you have satisfied yourself as to the spurious character of the specimen?—I may be satisfied, but I dare not go into court if it is above 10.

11718. Then may I take it that the lowest you go into court with is 10?—That is the lowest I should go into court with. I am saying what the conditions are at present; and I am telling you frankly what governs me.

11719. What you are saying is one of the very best examples as to the necessity for a standard, if the chemist himself believes that the article is not pure, and yet owing to the want of a standard he does not like to bring the case into court?—There must be numberless cases of public analysts who are in that position.

11720. Do you think that is the feeling among public analysts?—I am positive it is.

11721. They are anxious for a standard?—Undoubtedly; there is no protection for the public without a standard.

11722. And no protection for the public analyst in doubtful cases?—Public analysts have to protect themselves by not certifying.

11723. And then the public suffers?—The public suffers undoubtedly. In conversation with other public analysts I have found that to be the case.

11724. (*Professor Thorpe.*) Is not the fact that if you had indubitable evidence of the presence of cocoanut oil in a butter, even although your Reichert number had been 12 or higher, you would feel yourself justified in bringing that into court?—Yes, but I have never met with it yet. I suppose it is used.

11725. (*Sir Charles Cameron.*) If you certify that the butter had fallen below your standard, would you not think that the *onus probandi* would rest upon the defendant; you raise the presumption that there is cocoanut oil in the butter, and you put him to the proof that there is not?—If I discovered cocoanut oil in butter it would be an absolute adulteration, and I should say definitely that that was not of the nature and substance of the fat of milk.

11726. (*Professor Thorpe.*) The point is that cocoanut oil raises the Reichert-Wollny number?—Yes, it does.

11727. (*Sir Charles Cameron.*) What certain evidence would the analyst have as to putting this material into the butter? As I understand Professor Thorpe's question, if he knew by some means or other, I do not exactly know how, that, as a rule, the figure was raised by the introduction of this cocoanut oil, would he certify then that it was adulterated?—Not without he had other proof of the presence of the cocoanut oil, because it does not raise the butter figure although it would raise the Reichert figure in a margarine which did not contain butter-fat. When cottonseed oil was used—and it is used now, I suppose, in the margarine—it was possible to discover it by the Becchi process.

11728. Then you would have some other test showing the presence of that particular oil?—It was shown that the consumption of cottonseed cake by cows would lead to that re-action in the milk.

11729. Supposing there were 20 per cent. of that material put in, could you detect that?—I could detect any oil like cottonseed oil. There is the chloride of sulphur re-action.

11730. Which is a very good test for that?—Very excellent.

11731. Do you think in examining butter the presence of these foreign oils should be looked for as well as the presence of ordinary margarine; that is, would you employ collateral tests?—Yes, ordinary margarine is composed of these oils, and mixtures of them.

11732. Then, when you get a high figure which would apparently show it was butter, would you say that that high figure was due to the presence of such an oil as the oil we have been speaking of?—That oil does not give you a higher figure than butter does itself.

11733. (*Professor Thorpe.*) You are being asked about cocoanut oil, I think, and you are answering about cottonseed oil?—No, I am dealing now with cocoanut

Mr. C. Estcourt.

16 May 1902.

oil. I say that I think it would give about 3·6 Reichert number.

11734. Higher than that?—I mean taking 2½ grammes Reichert-Wollny would be about 7·2 c.c. $\frac{\text{Na HO}}{10}$.

11735. (*Mr. Hickey.*) Would you kindly tell the Committee what you figure for the soluble fatty acids of 4·5 would represent in the Reichert-Wollny numbers?—The volatile fatty acids are not given off by the Reichert-Wollny process, but they are all obtained by the other process. The quantity that is given off by the distillation process is only 9-10ths practically of the whole of the soluble fatty acids.

11736. (*Professor Thomson.*) What Mr. Hickey wants to know is whether your number given as 4·5 corresponds to the Reichert-Wollny number of 24 or 25?—4·5 would about correspond to 24.

11737. (*Mr. Hickey.*) I suppose you have found in your experience that the volatile fatty acids, in a great many cases, would run a great deal higher than the limit you have mentioned?—Very much higher in the majority of cases.

11738. Is there not a danger then in the fixing of a limit for volatile fatty acids of allowing adulteration to be carried on to a considerable extent, if you fix the limit at 24 Reichert-Wollny?—Less danger than there is now.

11739. Do you think that there is a larger amount of adulterated butter under the figure of 24 than the amount of pure butter above 24?—I can scarcely say that, because our attention has not been called to such low butters in this country, so I cannot say that that adulteration exists.

11740. Is not the information this, that the quantity of the butters that come under a Reichert-Wollny number of 24 is comparatively small?—That is so undoubtedly.

11741. Is there any serious risk that you would open the door to very considerable adulteration if you fixed a limit by regulation at 24?—I am putting it that the fact is well known that we do not take cases into Court, or prosecute, or certify unless it is below 4·5; so you would not affect the question at all by such a regulation.

11742. Practically then, there is a standard at the present time?—There is a limit now, really.

11743. Seeing that the standard is not generally known, is it not a serious matter to have it officially proclaimed, and thereby enable people to reduce all those butters with a Reichert-Wollny number of 28 or 30 down to 24?—I say it is universally known on the Continent what our methods are, and you would not affect it at all by issuing a regulation. I am speaking of imported butter more than anything else.

11744. Is the dominant idea in your mind in suggesting a limit that it would facilitate the work of public analysts in the cases that they have to bring into Court?—It would ensure the protection of the public also, which I think is the main thing. The analysts can protect themselves by giving certificates as to doubtful purity, and not going into Court at all; but the public are not protected then. This is the only way of protecting the public.

11745. Do you think that if a Reichert-Wollny figure of 24 was set up as a standard the public would be protected, and the administration of the law would be facilitated?—Yes; it would be much easier.

11746. You said in the course of your evidence that these Dutch samples which come in at low figures were inferior butters?—You see the general public have a different opinion of butter to the butter-maker, or the butter importer. There is a certain flavour which adds a value to the butter. You know that—no one can know it better than you—but that the public do not recognise. That value only remains in the butter as long as the importer or the wholesale merchant has it in his possession. Directly it gets into the shop I say that value is lost. I am not an expert in butter-tasting; I only know what pleases me, and I may choose a butter which is 10s. a cwt. cheaper than another. But I say the value of flavour only exists for the producer and the importer. Dr. van Rijn says: "This is a genuine butter, and the flavour is of value." I say: "No, I can imitate that butter, and put 30 per cent. of margarine into it, and you can do it." And anyone can do it who knows the constituents, and you shall say it is a fine quality of butter. The argument of Dr. van Rijn that because this has a fine flavour it must be good is absurd. I can make one equally good with a considerable quantity of margarine in it, and the analyst shall not be able to detect it, and the producer and the importer shall not be able to detect it, and the vendor shall not, and the public shall not.

11747. Is it your opinion that a butter with a low Reichert-Wollny figure is intrinsically and commercially inferior?—No.

11748. Do you mean that it is chemically inferior?—That is so undoubtedly. I say that the flavour is all that its market value is due to—not the quantity of soluble fatty acids, but the flavour that is produced in the butter during its manufacture.

11749. If merchants and the public generally find that there is practically no difference between the flavour of a butter with a Reichert-Wollny figure of 26 or 28, and a butter with a Reichert-Wollny figure of 20 or 22, where does the inferiority come in, except from the chemical standpoint?—That is the standpoint. In point of fact that are lots of imitations and of adulterations which do not impair to the purchaser the flavour or the edible value at all, it is the monetary value which steps in then, as I understand.

11750. (*Professor Thorpe.*) Milk-blended butter has an excellent flavour, has it not?—That is an excellent example.

11751. (*Mr. Hickey.*) What would you say of it, having regard to the volatile fatty acids?—It is *pro tanto* low by the fact that it contains 26 per cent. of water.

11752. You are in favour of the setting up of a standard of 16 per cent. of water in butter, are you not?—I should say that should be the limit. I think it is an excellent recommendation, because it meets almost every point. Some butters have got far beyond that—some Danish butters were getting up, I know, to 18 and 19 per cent. There are butters that came in from New Zealand and from Canada which were about 10 or 12, and you might say that the fixing of a standard will enable people to adulterate those butters; but at the same time it brings others down, and I think the general public are well protected by that 16 per cent.

11753. From your general experience do you think that 16 per cent. would be a fair limit to apply to Irish salt firkin butter?—The evidence that I have heard would have altered my opinion to a considerable extent if it could be demonstrated that it was impossible to keep it out; but I have never regarded it from that point of view; that is, I have never regarded it as impossible to keep excessive quantities of water out of Irish salt firkin butter; therefore I think 16 per cent. a fair enough standard.

11754. As a matter of fact you have no practical knowledge with regard to the manufacture of butter or its peculiarities?—I have seen it manufactured, but I cannot say that I have an acquaintance with it as you have, because I have not.

11755. You would not say absolutely that in the case of Irish salt firkin butter made under conditions which are pretty well known to everybody now, 16 per cent. would be a just limit to apply to that class of butter?—I myself up to this date have gone up as far as 18 per cent. always. I have never reported on Irish butter, because I do not know the origin of the samples I receive. Directly I found a butter containing a certain quantity of water, I examined to see whether it was salt or fresh butter, and if it were a fresh butter I should condemn it with 18 per cent.; if it were a salt butter I should not.

11756. (*Mr. Dunn.*) You are in favour of setting up a standard, are you not?—I would call it rather a limit.

11757. Do you think the Reichert-Wollny system is the best?—I think it is an excellent one, if you arrange it and modify it so that it shall be done with uniformity—a uniformity with which it is not carried out now.

11758. That has been the object of all the recent modifications, has it not?—No. I may point out to you that you may use a different size of retort, you may use a different size of condenser, you may have all those little points on which you differ, which will certainly make a little difference in the results, but if you have them governed by an apparatus of the same size, everybody using one of that sort, with certain limits as to the flame and the time of distillation, and so on, I think you will get very uniform results.

11759. You are in favour of still further defining all

Mr. C. Estcourt.

16 May 1902.

the points, whereas some appear to be opposed to too rigid difinitions?—It is not "still further defining," it is giving a process as well as a limit that I am in favour of.

11760. If that were done, what would be your limit?—I should say the limit which has always been taken, 24 Reichert-Wollny would be a very good limit.

11761. (*Professor Thomson.*) I understand that you recommend that certain standard processes should be employed?—That is so.

11762. Supposing standard processes were adopted, do you think there would be any danger of preventing or delaying the improvement of the processes for butter analysis?—No.

11763. Would those processes become stereotyped, and so prevent or delay improvement?—No. I have in my mind the suggestion of a Special Committee to be formed of members of the Board of Agriculture, scientific gentlemen, and others, who would constantly make changes and improvements when necessary in the methods and in the limits with their knowledge of what was going on in the world.

11764. You rather recommend that to the Committee, do you?—I trust that will be done.

11765. (*Mr. Gilchrist.*) Have you had experience in the analysis of any English butters which have shown a low quantity of soluble acids?—No. I say that I have met with very few, although I have had a large amount of experience in butters. I daresay I have done for the Corporation of Manchester from 100 to 200 samples a year, besides perhaps 200 more privately for importers, so that I have had a large experience. In only three instances have I found low Reichert-Wollny numbers in English and Irish butters.

11766. You mean a lower number than 24?—Yes.

Dr. WILLEM ROOSEGAARDE BISSCHOP, called; and Examined.

Dr. W. R. Bisschop.

11767. (*Major Craigie.*) I believe you are a Doctor of Laws, of Leyden University, an Advocate before the Court of Appeal at Amsterdam, and a member of the English Bar?—Yes.

11768. You are honorary secretary of the Netherlands Chamber of Commerce?—I am, but I am not attending as their representative, because I have not received any instructions from the Chamber.

11769. In your capacity as honorary secretary to the Chamber, I presume you have been conversant with the regulations which have been made in Holland guaranteeing the purity of the butter imported from that country?—Yes.

11770. Are you attending here simply in your private capacity?—Only in my private capacity.

11771. You have not got any instructions from your Government or from any institute to appear here?—No, I have not.

11772. Of course, you are aware that we have had certain evidence from Holland?—Yes, I know that Dr. van Rijn and Dr. van der Zande have given evidence before you.

11773. The Consul-General also was here. The evidence that you wish to give relates to the organisation of certain Dutch societies with a view to guaranteeing the purity of their butter?—Yes.

11774. The special control that you wish to bring to our notice is that of the Friesland Institute of Control?—Yes.

11775. How long ago was that body formed?—A year ago now; it was formed in May, 1901.

11776. Are there institutes of control in more than one province in Holland?—There is one other in the province of South Holland established in the Hague.

11777. Are those bodies formed in the same way in both places?—Yes, and they were both formed at the instigation of the provincial agricultural societies; one by the Friesland Agricultural Society, and the other by the Holland Agricultural Society.

11778. They are not Government institutions?—No, they are not.

11779. Nor are they formed under any special Dutch Act?—No, they are merely private institutions.

11780. Private institutions, may we say?—Yes.

11781. Are they representatives of factories or of individual producers?—The members are, entirely in Friesland, and in South Holland with one exception, factories. Traders are not admitted in Friesland, but they are not excluded in South Holland.

11782. Then these institutes may contain both?—They may.

11783. The factory, in a case of that sort, I presume, has to submit to the inspection of persons nominated by the Board?—Yes.

11784. Do they make this inspection without notice, and at irregular intervals?—Yes.

11785. What are the inspectors that are employed—are they chemists?—They are chemists or analysts.

11786. Are samples taken by those gentlemen?—Yes.

11787. Where are they analysed?—At the headquarters of the Institute. At the head of the Institute is a Doctor of Chemistry—he analyses the samples.

11788. The laboratory is not a Government institute?—No.

11789. But, as I understand, the management of one of these institutes is in the hands of the Dairy Adviser for the Government?—In Friesland the same gentleman who acts as Dairy Adviser, not for the Government, but for the Agricultural Society, is the gentleman under whose management the Institute of Control is placed.

11790. The inspectors make periodical reports to the central Board of the Institute?—Yes.

11791. How often do they visit, as a rule, although there is no regular time for visiting?—According to the reports which have been published they have visited the factories in Friesland about twice a month.

11792. Has any action been taken against any particular factories in consequence of their reports?—No. Friesland butter has, up to now, been beyond doubt genuine.

11793. Are there more qualities of butter than one made at those factories, or is it all sold under one designation?—I think it is sold simply as Friesland butter.

11794. Does the price vary very much in the different qualities here?—I should not like to say; that is rather an expert question.

11795. You are not yourself acquainted with that branch of the subject?—No. I know that they generally obtain the highest prices in the market.

11796. I see that two different kinds of butter are submitted for analysis, one for export, and one, as I understand, for local use?—The inspector who comes to control the factory can take samples of the butter which is ready for export; and if he doubts the quality of the butter they must allow him to have some butter made under his supervision, ready-made for export. Samples of the butter which he has found, and of the butter which has been made in his presence, are sent to the Institute of Control so that they can compare the two. From that comparison they can conclude whether any adulteration has taken place with regard to the butter that was all ready for export and was found on the premises by the inspector.

11797. Then the inspector does more than take analyses—he looks on while the butter making is going on?—Yes, they must allow him to see everything in the factory—they must not hide anything from him: he does not only control the butter, but he controls the entire factory.

11798. Including the machinery?—Yes.

11799. I presume the object of having this examination is to give a guarantee of quality?—Yes; the Institute of Control gives a guarantee to all the butter that is exported.

11800. Are you aware of any butter which has been exported from this district, made by the members of this Institute, which has been, on its receipt in this country, challenged as to its purity?—No.

11801. Have you not had any cases reported to you?—No.

Dr. W. R. Bisschop.

16 May 1902.

11802. I presume you would get to know it if there were a case?—Very likely I would get to know it, but I do not say that necessarily I should know it.

11803. You have not an arrangement to have all these cases reported to you?—No; but I am in close connection with the people out there, so very likely I would hear.

11804. Can you give the Committee an idea of the extent of the export of butter from Holland as a whole; and of the proportion that comes from this Friesland district?—It is very difficult to say; I have not the figures with me. Most of the butter which comes from Holland comes from Friesland. I should say that from 70 to 80 per cent. of it is Friesland butter.

11805. Is the whole extent of the export butter trade greater or less than it was some years ago?—It is an increasing trade.

11806. Does all the exported butter come to this country, or does some of it go to Belgium?—Some goes to Belgium and to Germany.

11807. Can you give the proportions of the three different countries?—Not without referring to the statistics.

11808. The Dutch trade accounts would show it?—Yes, and if you want them I can forward them to you.

11809. With regard to the Dutch law on the matter, in your *précis* you quote an Act of the 9th July, 1900—has there been any modification of that since it was passed?—No.

11810. Is that law working satisfactorily as regards internal prosecutions for butter?—We have had prosecutions for butter lately, and I must say that it was shown that the law did not cover the adulteration of butter—those cases were decided in March, 1902.

11811. In what manner is the law enforced: is there a public system of analysis and a defined standard for butter?—There is no defined standard for butter. Analysts like Dr. van de Zande and Dr. van Rijn, who have been before you, are the officials under whose supervision the butter trade is placed. They can take analyses whenever they like. Dr van Rijn has been the prosecutor in those cases that I have mentioned.

11812. We have received from the Dutch Government an official communication explaining the regulations, and I understand from that communication, that before the year 1900 it was directed by Ministerial Decree that a butter with a refraction reading of not more than 53·5 at 25° c., might be considered, without further examination, as unadulterated; but perhaps you are not aware of these details?—I am not—these are rather technical points.

11813. You are not a chemist, and therefore you are not prepared to give evidence upon the chemical part of the subject which is before us?—No.

11814. What you wish to lay before this Committee is with regard to the standard that is to be fixed in this country?—Yes.

11815. You know that in the Reference to this Committee we are asked to recommend at what figure a presumption shall be raised that the butter is not genuine. We have dealt with the question of the proportion of water in butter, and you have probably seen the Regulation which has followed upon our Recommendation?—I have.

11816. Do you concur generally with that Regulation as suitable to Dutch butter?—Yes.

11817. With regard to the other constituents, do you wish to lay any suggestion before the Committee as to the figure which should raise a presumption of adulteration?—I should be very much against any figure being adopted.

11818. Then you would propose to have no standard of a chemical character?—Certainly not.

11819. What are your reasons for that?—Chemists have only adopted a standard because it is impossible for them to say whether a butter is genuine or not from mere analysis. No method of analysis has yet been found by which it is possible to state the difference between unadulterated and adulterated butter beyond doubt. Secondly, the quantity or the relation of volatile acids in butter has nothing to do with its quality, while the quantity of water in butter has certainly to do with the quality; and, thirdly, it is possible to regulate the quantity of water in butter, but it is impossible to regulate the figure with reference to volatile acids or any other constituent of butter.

11820. You are, I think, of opinion that the composition of the butter is affected by the treatment or maltreatment of the cows producing the butter?—All those opinions are founded upon experiments, and I have not yet read any report in any country where it was shown to be possible beyond doubt to regulate the figures.

11821. You know Dr. van Rijn's communication on the subject?—Yes.

11822. You have seen those figures that he has produced, showing that by a certain amended treatment of the animals and herds generally certain results could be secured?—He has made some experiments certainly; he is responsible for what he has written down there. From what I have read, not only with regard to Dutch butter, but with regard to any butter from other countries, and especially the Siberian butter, it is impossible yet to fix any method whereby the analytical composition of butter can be regulated.

11823. But if there is this uncertainty, how is it that you proceed to ascertain whether the butter is or is not genuine in the case of these factories and other associated bodies?—That is why I wanted to place before you a system of control that has been adopted in Holland, and which has been adopted more or less also in Denmark.

11824. That system of control rests as its basis upon analysis?—Its basis is the continual control of the factories, and, as far as I know, the experts agree that if they have control of the factory during a certain period—I will say a year or more than a year—they can detect, from the experience of having the butter analysed twice a month, whether such butter as they have now under analysis is genuine or not.

11825. How can they detect that from analysis if no analysis can tell you the facts with regard to the butter?—I am not an expert, but as far as I have heard they can only do so because it is possible to compare analyses during a long period.

11826. Would it not be possible then to set up a standard which would take account of all the acquired experience in these matters?—As far as I can see, no; because the different composition of butter first of all during certain parts of the year, and, secondly, in different parts of the country, and in different countries, varies to such an extent that, according to my mind, it would be impossible to say with certainty what composition should be the right one.

11827. In your opinion, no analytical system can determine the chemical constituents of butter?—Not with certainty.

11828. But analyses conducted over a long period might eventually give the people dealing with the butter from that locality some idea whether it was genuine or not?—Whether a certain quantity made by a certain factory, and exported at a certain time, was of doubtful quality or not? It is impossible to make a general rule, and it is only by having the supervision of a factory during a long time that it is possible, as far as I know, for the same expert who has had that factory under his supervision during that time to say whether a certain quantity of butter which is put before him for analysis is of doubtful quality or not.

11829. Your theory then is that the butter of each locality, and made under each different process, would require to be determined by a different test?—I will not say whether the same test would apply; I can only say that, according to my mind, it would require an expert who is familiar with that particular locality.

11829*. The chemist in analysing a butter must know the origin and history of that butter before he can draw any deduction from the chemical figures before him?—I am of that opinion.

11830. But you are not a chemist, and that is only your opinion?—I am not a chemist, and that is an opinion I base upon what I have read and what I have seen.

11831. Do you agree with Dr. van Rijn in his statement that exceptionally poor butters are attributable to the neglect to properly house the dairy cattle?—I am not an expert, and I would not like to give an answer to that question.

11832. Not even on that subject?—I think it is a highly technical subject.

11833. You are not a chemist, but you are acquainted with dairy management and with the man-

Dr. W. R. Bisschop.

16 May 1902.

agement of cattle?—I know that there is a different management in different provinces in Holland, and I know that Dr. van Rijn deduces from that certain arguments and certain conclusions, but I am not a sufficient expert to test those conclusions.

11834. You do not accept or endorse those proposals from your own knowledge—you cannot?—Neither the one nor the other.

11835. (*Sir Charles Cameron.*) You gave a very unequivocal answer to the question as to the fixing of a standard; you said you did not think it was possible, with our present knowledge, to fix any standard with regard to the adulteration of butter by foreign fats?—I do not think fixing a standard would be of use to check adulteration, because adulteration would continue up to the point fixed as standard, and would then be sanctioned by law.

11836. So you say it would not be useful if a standard were fixed?—It would not be useful, because adulteration would go on up to the point of the standard.

11837. You have brought to bear on the study of this question your knowledge of law and logic as a Doctor of Laws and as a barrister, and therefore you are competent to form an opinion on facts. Upon what statements of facts do you base your opinion as to the impossibility of detecting adulteration in butter?—First of all, on account of the chemists declaring themselves unqualified to say what is the exact analytical difference between, for instance, margarine and butter; secondly, the experts have found genuine unadulterated butter with a Reichert-Wollny figure of 16, and adulterated butter with a much higher Reichert-Wollny figure—namely, 23 and 25. If the standard were fixed, say, at a Reichert-Wollny figure of 25, say, adulteration would go on; up to that point, people would mix butters which have a very high figure with substances which have a very low figure, and it would be necessary to pass such compounds as genuine butters, because the standard would have been fixed, and there would be nothing known of the history of the butter showing that it had been adulterated.

11838. Does not the fact that they will take a high figure butter for the purpose of adulterating it with suet, or with lard, prove that there are criteria as to what is genuine butter?—How is it possible if you have a figure varying from that particular figure which I have generally heard quoted as the most possible, or most probable, standard—if you have butters varying from 16 up to 30—and I have heard of one going up to 36. I do not know if that is right.

11839. (*Professor Thomson.*) Would you kindly explain what you understand by the figure you are now speaking of; is it what we know as the Reichert Wollny figure?—Yes.

11840. The Reichert-Wollny numbers you have just stated are entirely different numbers from what we have been accustomed to hear spoken of?—Of course, I can only go by the figures that I have already had before me.

11841. (*Sir Charles Cameron.*) You said, in reply to a question put to you by Major Craigie, that you thought it was impossible to distinguish an admixture of margarine or other foreign fats with butter fats; do you mean to say that you would apply that to every conceivable mixture? Take a case where 90 per cent. of margarine has been added to butter; would that not be detectable by our present means?—Very likely; I do not know; but the difficulty does not exist there. Where the mixture is to such an extent as that, there would be no doubt as to the quality or the quantity of the admixture; but the moment that you come to the mixtures that are sold in this country—that is, mixtures of 20 per cent. of margarine and 80 per cent. of butter—then the difficulty arises.

11842. The question put to you was: "Is it possible to detect the presence of foreign fats in butter?" and you said it was not by any method at present known; you spoke generally, and you did not restrict it to 20 or 30 or 40 per cent.?—I beg your pardon; of course. I do restrict it. What I said applied to the smaller quantities.

11843. Then your observation merely applied to the impossibility of detecting small quantities?—Of detecting the exact quantity—you may put it that way.

11844. You did not mean that a chemical analysis was wholly inoperative?—Not wholly. As far as I have seen, it has broken down entirely with regard to those cases in the Dutch courts where the people have been acquitted. Dr. van Rijn was called as a witness, and declared that, in his opinion, the butter was adulterated, and, I think, in those cases the analytical method has proved itself to be of not sufficient value to detect adulteration in particular cases.

11845. You surely must recognise that the ordinary public analyst, or any other analyst, who has a specimen of butter submitted to him for analysis must adopt, at all events for himself, some standard?—Yes, but he himself admits, and I have heard men of the highest standing——

11846. Who is he that admits?—Several.

11847. (*Major Craigie.*) Could you name any analyst?—Dr. Hehner, who is well known to your Committee, and Dr. Van Rijn himself.

11848. (*Sir Charles Cameron.*) What did he admit?—That it is an impossibility to detect with certainty the quantity of the adulteration or the extent to which adulteration was carried on.

11849. But did he not admit that it was possible to detect adulteration?—Not always.

11850. But sometimes?—Sometimes.

11851. Let us deal with when it is sometimes possible to do it; must there not be some figure to indicate the mere fact of adulteration?—I do not think so. Dr. Hehner is known, as far as I have heard him in court, to adopt seven methods, and he distinctly declared in court in one of the cases that I was attending that he did not come to a conclusion without comparing the results of those seven methods, and even then he was sometimes in doubt.

11852. Did you read the evidence of any other chemist who held different opinions, and who has stated that it is quite possible, by the use of these methods, or some of them, to detect adulteration?—I have heard Dr. Hehner, I have heard Mr. Taylor, and I have heard Mr. Cassal, three analysts in London, and all three agreed on that particular point, that they could not by one method detect whether a butter was genuine or not.

11853. That is not what Mr. Cassal said yesterday to us; he told us that he preferred to adopt two methods, but that he would rely even upon one of them?—That is only what I have heard in court; it may be that he has modified his opinion.

11854. You said in reference to butter that although the quantity of water is under control to a certain extent, the amount of the other natural ingredients in butter, or in the milk that produces the butter, is not under control?—That is so.

11855. Do you not think that when cows are well fed and kept under proper conditions the quality of their milk is likely to be better than if they are exposed to the cold?—Yes, the quality would certainly be improved.

11856. Butter contains 94 or 95 per cent. of the same constituents that suet and lard and other fats from which margarine is manufactured contain. Surely, therefore, there must be great importance attaching to the 5 or 6 per cent. of those fats that are peculiar to butter?—I think so.

11857. Does not the difference between lard and butter in fact arise from this 5 or 6 per cent. of the peculiar fats?—Yes.

11858. Putting chemical analysis out of the question, is it not commonsense that if these fats be very deficient the characteristic properties of butter will be weakened?—It would be commonsense certainly if the analysts themselves had not acknowledged that it was very difficult.

11859. I do not think that we have that clear scientific statement?—I leave it there. I can only say what I have heard analysts saying in court and out of court, and what I have heard is always to that effect—that it is with the greatest difficulty that they can decide whether they have to do with genuine butter or not on account of the difference being so very small, and because there are no ingredients of which they can with certainty say *these* are different.

11860. Going back to one of my earlier questions; you say that the public analyst or the ordinary analyst must have some data to go upon in expressing an opinion?—He does.

11861. Whether he does or not, ought he not to have

Dr. W. R. Bisschop.

16 May 1902.

some data to go upon in expressing an opinion. Supposing he gets a specimen of margarine pure and simple, as every public analyst does from time to time, would he have any difficult in expressing an opinion that it was not butter?—As far as I can see, no.

11862. Do you admit that margarine itself, which may only contain 3 or 4 per cent. of butter, can be detected?—Yes.

11863. Have you ever heard Dr. Hehner or anybody else say that margarine cannot be distinguished from butter?—Pure margarine? Certainly not.

11864. Would there be any difficulty, if 50 per cent. of margarine were added to butter, of its not being detected?—I should not like to commit myself with regard to a percentage whether it is detectable or not. I know that the nearer you come to the 50 per cent. the more difficult it becomes to detect it.

11865. With certain percentages surely there can be no difficulty?—I have often heard difficulty expressed with regard to 20 per cent.

11866. I daresay the difficulty does begin to occur there?—I am talking of 80 per cent. of butter and 20 per cent. of margarine, or 80 per cent. of margarine and 20 per cent. of butter.

11867. (*Major Craigie.*) However, you are only giving us hearsay evidence now, as you have no special knowledge on these points?—No; I am only saying what I have heard.

11868. You are of opinion, looking at it from the legal point of view, that the agreement among chemists is not sufficient to warrant the fixing of a standard on any chemical basis?—Certainly.

11869. (*Sir Charles Cameron.*) There is a great difference between fixing a standard, having regard to the addition, say, of 10 or 15 per cent., and having regard to the addition of 40 or 50 per cent.?—It is very difficult for me to answer you from an analytical point of view; I can only express to you my opinion as a lawyer, and I do not think in law you will ever get a standard based upon what the analysts know now.

11870. You are speaking now from the lawyer's point of view?—According to my mind, it will be absolutely impossible to get a judge to pronounce a butter not to be genuine when he has so much conflicting evidence from experts.

11871. Do you think that any Court of Justice would hold it impossible for any analyst, from what we know about analytical data at the present time, to say that a butter was adulterated with 50 per cent. of margarine?—Not if the court were placed in this position: that all the experts that were called on both sides agreed on the point; but as far as I have seen, and as far as I have heard, I have never found that the analysts on one side agreed with the analysts on the other side.

11872. They sometimes do as regards standards, but they vary as to the deductions?—And with regard to those niceties where the mixture has been to a small small extent or to an extent nearing 50 per cent.

11873. I am only dealing now with the 50 per cent. admixture?—At 50 per cent. the difficulty would begin.

11874. Would there be the same doubt with regard to 50 per cent. that there would be with regard to 5 or 10 per cent.?—I do not know.

11875. If there was there would be no use in bringing any case into court at all?—I see "The Grocer" every week, and I read the cases of adulteration that are tried in this country. I always find that they are certain where the adulteration is 100 per cent.—that is, where pure margarine is sold as butter—and where 80 per cent. of margarine is added to butter, and I have seen cases of 70 per cent. and 60 per cent. where they are certain; but at 60 per cent. the doubt begins.

11876. At 60 per cent.?—Yes, according to what I have read. I deduce therefrom that the lower you come, the less margarine is added to the butter, the more difficult it is for the analyst to detect it.

11877. That is admitted?—Then, taking the Dutch cases where it has been declared by the analysts that, according to their opinion, such butter of which they knew the history must be adulterated, even then the courts of law did not allow on what they had before them that such butter was proved to be adulterated. I should think it would be impossible for an analyst to say, "*This* butter, legally speaking, is adulterated, and *that* butter is unadulterated."

11878. Then do you say that it is impossible to fix any standard to deal with any amount of adulteration up to 80 per cent?—Not for any amount. I say once more that I have seen cases of 100 per cent., and 90 per cent., and 80 per cent., where it is beyond doubt.

11879. Do you remember any case where two analysts went into court and one said to the other, "It is 80 per cent"?—These cases in the courts of law which I see every week are usually cases of 100 per cent., and 90 per cent., and 80 per cent.

11880. And in those cases no analyst would say it was pure?—Perhaps I misunderstood your question, but I mean to say that there was no difference of opinion there.

11881. Your general opinion is, no standard, and let every case be fought out on the individual testimony of the analysts; is that it?—No, I want to place before you what I think would be the proper method, and the right method, and that is, to have control of the factories where the butter is made. I have heard from all analysts—and here there was no difference of opinion—that if you know the history of the butter, and you have had the factory for a certain period under your supervision, you can say with the greatest probability whether a certain quantity made in that factory is genuine butter or not.

11882. (*Major Craigie.*) That is entirely beyond the reference to this Committee. This Committee has no power to recommend any alteration of the law. It is sitting here simply to advise under Section 4 of the Act of 1899, the point at which the presumption shall be thrown upon the seller of the butter, therefore any evidence merely suggesting that some other course should be taken by some new Act of Parliament which would admit butter from a controlling station, either in England or in Holland, would be outside our province?—I beg your pardon, but what I suggest would not require a new Act of Parliament.

11883. Do you suggest that it could be done under the present Act?—Yes.

11884. If you can show how, without establishing a standard, the same presumption can be raised, we shall be glad to hear you—but I do not see how you can?—If the authorities in this country are aware of the system of control which is carried on in other countries, and at the same time know what sort of butter is introduced into this country by some trade mark or figure, or secret identification mark that is put on the butter, showing where the butter comes from, and if at the same time they are in connection with the controlling station in the exporting country, it would, to my mind, be possible on finding a butter imported of doubtful character, to inform the controlling station hereof. That controlling station would immediately know whence that butter came; they would know the history of the factory and all about it, and they could at once take mesaures either for securing that such butter should no longer be exported, or to prove the genuineness of that butter beyond doubt. I do not think any method can be satisfactory without at the same time recognising control systems at the places where the butter is made, whether they be in this country or outside this country.

11885. (*Sir Charles Cameron.*) Analysts have only to deal with the product as such, but you say the origin must be ascertained?—The history of the butter must be ascertained.

11886. (*Major Craigie.*) That is an alternative suggestion to having a staindard?—Yes, and it is not necessary to have that by Act of Parliament.

11887. (*Sir Charles Cameron.*) We should have a series of standards in that case. Say that a man goes into a shop and buys a pound of butter; the local analyst examines it, and he finds it contains so much of soluble fatty acids; must not the standard quantity in the district that produces that butter first be ascertained by analysis before the analyst can say whether that butter is a genuine one, if your system is adopted?—Yes, but that butter will in that case be under analysis in the place where the butter is made.

11888. There is a standard there then?—There is no standard.

11889. One is found?—There is no standard. As far as I have seen chemists have seven standards or eight. They all can follow the same method, and they can have all the butter of that particular factory analysed at different times of the year. They will know thereby

Dr. W. R. Bisschop.

16 May 1902.

exactly the character of the butter produced at that factory. They can, therefore, furnish the places where the butter is received, and where the genuineness of the butter is in doubt, with all the particulars that are necessary, without adopting fixed and hard and fast rules, and saying, "Such and such a butter must have this figure or that figure which has been recognised as a standard."

11890. Practically what would be the use of making those analyses in each district unless figures are given? Your analysis must show that the butter is of the composition that we have found it to be here, and would not that be a standard?—I think that those papers are before you——

11891. Please answer that question, whether that would be a standard or not?—No.

11892. I understood that you ascertained by your controlled experiments that the butter is of a certain quality?—It has nothing to do with quality; we get certain analytical figures.

11893. It has a certain analytical quality and a certain amount of the characteristic fats of butter; you say that the local analyst ought not to express an opinion, but suppose he finds the butter to fall below the analytical data got in the district from which the butter came, would he not in finding that necessarily be making use of a standard?—He might himself have adopted a standard, and he might then express an opinion; but it is not at all certain that the standard he goes by is the standard that should be adopted for that particular butter.

11894. You have not heard the question rightly, I think. I say supposing the local analyst, say the city analyst for Manchester, is aware that the butter comes from Friesland, and that the quality of it is known, must he not know the standard quality of butter in Friesland before he can express an opinion upon its genuineness?—There is no standard quality there, because the butter from different factories there gives different figures analytically.

11895. What is the good of having controlling stations unless some data are given to the local analyst to tell him what the butter from that place should be?—First of all, if I may speak from a practical standpoint, the institutes of control in Friesland and South Holland, and I think every control station in every country where control stations exist, guarantee the purity of the butter.

11896. (*Major Craigie.*) Warrants it you mean?—Yes.

11897. (*Sir Charles Cameron.*) Is that not a standard?—Where is the standard? I should not like to express that warranty in figures.

11898. It must be expressed in some tangible way, so that an ordinary person would know what it is? It must be expressed in some numerical form?—No.

11899. (*Mr. Hickey.*) They believe it to be genuine?—If they warrant it and hear from this country that "such and such a butter has been imported, coming from such a place, and warranted by you, but is not genuine," then they can, in the first place, undertake the defence; secondly, if it is proved to themselves, according to the analysis which they take of the butters coming from that particular factory, that this butter is doubtful in quality, they can prevent that factory from producing any more butter by the system they have—by exposing them to publicity.

11900. (*Major Craigie.*) This relates entirely to your internal administration in Holland?—It is exactly the same in Denmark.

11901. In the case of an actual prosecution in this country, the vendor of the butter is brought before the court charged with selling butter which is not genuine; he pleads, if I understand your suggestion, as a defence, that he has a warranty from somebody else; that would go through the ordinary course of law, and he would have a right of set-off. If it is merely a question of warranty, then you are not proposing any change in the law at all, but I understood at the beginning of your evidence, and also from the Dutch representatives who came before us in January, that your point was rather with reference to Section 1 of the Act of 1899, which deals with the examination by the Customs at the port on the arrival of the Dutch butter, the suggestion being that a certain mark or stamp should be accepted by the Customs as excluding that butter from examination under Section 1?—That, of course, would be a recognition of the butter; the moment the system was recognised that would be the logical consequence.

11902. You have come here rather to suggest that, and you are not now applying your system so much to the case my colleague was putting to you of a prosecution in Manchester in the case of a sample, of which no one might know the origin except the actual vendor himself?—They could bring evidence, if they liked, about the butter.

11903. They could do so if it had never broken bulk; that is, assuming the butter was in a package properly marked?—Yes; then they could say it comes from such and such a factory.

11904. I think I quite understand what you are suggesting to us. It is the acceptance of some mark agreed upon as a guarantee that the butter should be exempt from prosecution?—No, I will not say exempt from prosecution, because it might be that really adulteration is going on, but I say that the prosecution should lie there where the butter is made, and not here where the butter is sold.

11905. You mistake my point; under Section 1 of the Act of 1899, the Customs must take a sample of the Dutch butter?—If the Customs are in correspondence with these control stations—I am speaking only for Holland, but the same would apply to Denmark and other places—they could let the punishment fall at the place where the butter is made.

11906. The person who offends, according to the law, is the English importer, and not the foreign maker or the foreign exporter; he is the only person amenable to our courts?—May I express myself in another way. Perhaps I shall make myself more clear. Supposing you have adopted a standard: then the importer, on being accused of having imported adulterated butter, has nothing else to do than to plead or to prove that that butter comes up to a certain standard; he does not prove any more that that butter is not adulterated; he simply proves that it comes up to a certain standard. Now, I think that the moment this is done the butter can be adulterated up to that standard without its being necessary to prove that it is not adulterated.

11907. That possibility would follow from all standards?—Yes, but in the absence of a standard, the recognition of a system of controlling the manufacture would meet the difficulty.

11908. (*Professor Thomson.*) I think what you mean is perfectly clear. It is a case of the lawyer *versus* the chemist. Under this control which you have in Holland you guarantee the value of the butter, do you not?—Not the value, but the genuineness.

11909. In making this guarantee you must have certain data to go upon?—Yes.

11910. These data, I find from the tables that have been sent to us, relate to the Reichert-Wollny number, and also to the refractometer number?—These figures which have been published have simply gone to show the difference between those numbers.

11911. In issuing their certificate, do they pay no attention to the chemical question?—I think they do; I cannot say how far they do.

11912. You have been dealing with the question of control entirely?—Yes; they give the certificate to the factory that is under their control.

11913. Because the butter has been well made?—Because it is under their control.

11914. Because they have seen the butter well made?—Yes.

11915. And they do depend upon the chemical analysis?—That I cannot say. I know for certain that samples are taken, and I know that the gentlemen who are at the head of the institute of control in both provinces, as well Friesland as in South Holland, analyse the samples. Those gentlemen know exactly what are the constituents of the particular butters from all the different factories, as they have shown in these lists, but how far they are guided thereby in giving the certificate I do not know.

11916. Would you say that they give their certificate from general observation and general conclusions, and not from specific determinations?—I will not say exactly whether they do or whether they do not, but I know that the butter of all the factories that are under their control is examined and analysed.

11917. Do you think that your views with regard to

Dr. W. R. Bisschop.

16 May 1902.

the fixing of a standard would be changed in any way supposing that the chemical methods by which the standards were arrived at were also of a fixed and standard nature?—As a lawyer, I shall change my opinion the moment that I notice from experience that there is no difference of opinion between analysts.

11918. (*Sir Charles Cameron.*) The control is largely analytical, is it not?—The control is, first of all, analytical with regard to the samples which go to the head of the control station, and also with regard to the factories through the inspectors who go round.

11919. Do they see that the manufacturers are not putting in foreign fats?—They have to see how a factory is managed, and whether any foreign fat is near it.

11920. Still, there is an analytical control as well?—Yes.

11921. Do they not ascertain then what the analytical figures are with regard to each factory?—Yes, and they publish them.

11922. If they found that suddenly a butter fell considerably below the analytical figure that was obtained from the manufactory, what would be done?—They would simply put that down, and that would be added to the history of that particular factory's butter.

11923. They would pass no condemnation, or anything of that sort?—I cannot say; I do not say that they would directly, supposing the result of the visits of the inspectors was to show that that factory is beyond doubt a factory where they make genuine butter, and that they had not any margarine in the place.

11924. Then what is the use of the analysis?—It enables them to know the history of the butter. It is known to you that Frisian butter has not the same analysis at all times of the year.

11925. What is the good of all that, if we are not to make any use of it? What use can we make of it?—This use: that it would show the impossiblility of going by certain fixed standards with regard to certain butter. According to my mind, the analytical results of Frisian butter have shown that it is very dangerous to adopt a certain fixed method or a certain fixed standard for certain particular butters.

11926. Is it done with the object of seeing whether a standard could be devised?—No, it is simply done with the object of having a history of the butter.

11927. If in any case it suddenly fell below the usual figures, would there be no inquiry as to why it fell so much below, and whether there was adulteration?—It is likely.

11928. Are they so immaculate that under no circumstances would they adulterate?—No. With regard to the Frisian butters, I think they are beyond doubt genuine, because there is no margarine whatever made in Friesland.

11929. (*Mr. Hickey.*) Do you say there is no margarine made in Friesland?—Yes.

11930. Is not Hertogenbosch in Friesland?—No, that is in North Brabant. As far as I know, margarine factories are only in the southern part of the country—in Rotterdam and Hertogenbosch, for instance, and Friesland is the most northern part.

11931. I suppose you have no knowledge of the commercial bearings of this question, as you are not engaged in the trade?—I am not engaged in the trade, but the members of our Chamber are all traders.

11932. Are you in a position to say that there is very little adulteration of butter going on in Holland?—I should not like to say.

11933. Have you any knowledge that butter containing a large proportion of volatile fatty acids is bought at Hertogenbosch and Eindhoven, and carried to other parts of Holland, mixed with foreign fat, and the compound is exported to England as pure butter?—I have no official knowledge of it.

11934. Do you know that such a thing goes on in Holland at the present time?—I have been told so.

11935. Have you heard of any cases?—Not of particular cases, but I have been told so in connection with the prosecutions which took place here last year.

11936. Are you aware that the practice of buying butter at the places that I have referred to has gone on for several years in Holland?—If I have to answer this question upon my own knowledge, I have no knowledge of that; I have only heard of it. Of course, I have not been at those places, and I have never been to the markets. Our big markets for butter are Eindhoven, Hertogenbosch, and Zwolle.

11937. Are there any marks on the casks or packages of Dutch butter imported into England indicating that they come under the Board of Control that you have mentioned, and suggesting that they are pure?—Yes, the Friesland Institute of Control gives a certificate.

11938. I asked whether there were any marks on the casks or packages?—First of all, the Co-operative Society of Butter Factories gives the mark "Nedraw."

11939. Is that mark only given to the butter that is supposed to be pure?—Only to the butter from the factories which are members of this particular society, the Co-operative Society. Every factory has a number, and that number is only known to the society.

11940. About what proportion of all the butter imported into England from Holland would that mark be on?—I cannot say exactly, because most of the butter goes to the North of England, not to London; it is directly exported to Hull. I have here a copy of the mark adopted by the Institute of Control in South Holland.

11941. Do you say that mark is put upon all the butters sent by these voluntary dairy associations?—Sent by the members. One of the punishments is, that the moment they are detected making butter which is adulterated or even of having mixed other butter with their own butter, their permission to use this mark is withdrawn, and their name is published in the papers.

11942. Will you tell the Committee what is about the annual value of all the butter imported from Holland into England?—I have not those figures in my head, but I think your own official statistics are very well up-to-date, and I take my figures generally from them. I think it is about £290,000.

11943. Is it your evidence that out of the eleven provinces of Holland only two make butter for exportation?—I could not say that, but the principal butter-making province is Friesland. Friesland is entirely living on its dairy produce and its cattle.

11944. (*Mr. Gibbons.*) What evidence can you give us that as low a Reichert-Wollny figure as 16 has been found in genuine butter?—I have been told so by Dr. van Rijn.

11945. But you have no evidence at all to show that?—I myself have none.

11946. We have not heard of that figure before?—I have only heard of it from Dr. van Rijn; I hope I am not mistaken in the figure.

11947. Do I understand that the butter factories in Holland are under constant supervision, and that no admixture of foreign fats is allowed to be brought into those factories?—It applies only to those factories who are members of the Institute of Control in Friesland, or of the Institute of Control in South Holland.

11948. Then it is simply a voluntary supervision?—It is entirely a voluntary affair.

11949. It is not at all like the inspection that is carried out in England over our breweries; it is not made compulsory by the State?—No.

11950. (*Mr. Dunn.*) You appear to think that instead of fixing a standard, the way out of the difficulty of adulteration is inspection at the factory; does that inspection consist of constant watching or of analyses—analytical inspection, so to speak?—As far as I know both systems are adopted in Friesland and in South Holland, because they have an inspector to go round to the factories, and they have a chemist at the head of the Institute of Control.

11951. Having an analyst apparently shows that they do not consider the inspection by itself thoroughly satisfactory?—I should think not.

11952. If you are going to have analytical inspection, do you think it is better to have it at the manufacturers' end or at the retailers' end?—I should think it would be necessary to have it at both ends.

11953. It appears to me, if you depend on analyses, that when the butter is on the retailer's counter the analysis is final, whereas if the analysis takes place at the point of manufacture, the butter must be watched and re-watched during all its subsequent handling, until it reaches the consumer, in order to protect the consumer?—I entirely agree with

Dr. W. K Bisschop.

16 May 1902.

you there; but may I point out that if you are relying on the last analysis you are thereby leaving out the analysis at the controlling station and the inspection at the factory. If you could get a system where both were combined, by which you take notice of the analysis and of the control system at the factory, as well as of the analysis at the retailer's end, I think you would go farther than where you entirely rely on the analysis at the retailer's end.

11954. Undoubtedly, but all these inspections and analyses cost money?—Yes, but the analysis and the inspection at the factories is at a much greater cost than the analysis at the retailer's end, and if the exporting country is going to the great expense of analysing and controlling the manufacture of butter I do not think you can complain, or take no notice of it.

11955. We do not object to it by any means. We do not complain if they adopt this system on the Continent?—As far as I know the system is adopted in different countries.

11956. (*Mr. Gibbons.*) Could you name any other country in which the same system is adopted?—Denmark.

11957. Could you name any other country beside that?—I should not like to commit myself in saying that exactly the same system is adopted in other countries.

11958. As I understand, it is simply voluntary in all cases, and there is no Government supervision?—That is so; there are 800 factories under supervision in Denmark.

11959. Voluntarily, as in Holland?—Yes. In Holland we only began last year, so the results are not yet a great

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TWENTY-THIRD DAY.

Wednesday, 21st January 1903.

MEETING HELD AT 32, ABINGDON STREET, WESTMINSTER.

PRESENT:

The Right Hon. HORACE CURZON PLUNKETT, F.R.S. (*Chairman*).

Sir CHARLES A. CAMERON, C.B., M.D.
Professor T. E. THORPE, C.B., LL.D., F.R.S.
Major P. G. CRAIGIE, C.B.
Mr. ROBERT A. ANDERSON.

Mr. CHRISTOPHER DUNN, J.P.
Mr. GEORGE GIBBONS.
Mr. JOHN GILCHRIST.
Professor J. M. THOMSON, LL.D., F.R.S.

Mr. A. E. BALLEINE, *Secretary*

Mr. A. E. BROOKE-HUNT, called; and Examined.

Mr. A. E. Brooke-Hunt.

11960. (*Chairman.*) I understand that you are one of the Superintending Inspectors of the Board of Agriculture?—I am.

11961. You come to give evidence on the subject of the butter made at the Midland Dairy Institute and at the Garforth Farm, which was sent for analysis to the Government Laboratory in 1901, for the purposes of this inquiry?—That is so.

11962. (*Major Craigie.*) You, I think, received instructions previous to the commencement of this Committee's investigations to assist the Board of Agriculture in suggesting to the Government Laboratory the names of certain farms in England and Wales and also dairy institutes, from which we might take samples for guidance as to the composition of genuine butter?—Yes, I did.

11963. At a later date you had an opportunity of seeing the evidence given as to the results of these samples by Mr. Lewin on the 14th May last, I believe?—That is so.

11964. I believe you are only able to speak as regards the selection of the farms and dairies in England and Wales, as you were not consulted as regards either Scotland or Ireland?—I can only speak with reference to the selected farms and dairies in England and Wales, with the exception of No. 7, the Buscot Park Dairy, Faringdon, which I am not acquainted with.

11965. In selecting those particular farms and dairies, was there any guiding rule discussed before the Committee began its labours?—It was sought as far as possible to get institutions which would be representative not only of the country generally, but of the different breeds of cattle in the country.

11966. Was it originally intended to take two sets of samples from each place, or only a single set, even where there were mixed herds?—I understand it was originally intended that samples should be taken from the mixed milk of the whole of the herd at each farm, and also, if possible, from the milk of certain cows; but as I gather, it was considered unnecessary to obtain more than one set of samples, and this, I believe, was from the milk of selected cows—so they were all more or less going down in their period of lactation.

11967. In the case of farm No. 6, there are two lines in the table handed in by Mr. Lewin (see Appendix , p.); does one of those lines represent the mixed herd and the other the selected cows?—I understand that to be so, but the details were given to the Government Laboratory.

11968. It is only in the case of Garforth and the Colonial College that we have the two results shown in the table, is it not?—As far as I am aware, that is so.

11969. I believe you made some notes as to the soils of the different farms; will you kindly tell us what you know on that point?—These are notes that I made at the time of going round: No. 1 is a poor chalk farm; on No. 2 the land is of fair quality, but gravelly; on No. 3 the land is light naturally; on No. 4 the land, as a rule, is strong clay, but one field of 20-30 acres is gravelly; on No. 5 the land is a good red loam or clayey loam; on No. 6 the land is mostly clay, with a ridge of medium loam running through it, but some four acres are peaty; No. 8 is one of the best stock farms in Anglesey, and though exposed no doubt at times to heavy gales, the climatic conditions are, I should say, the reverse of severe; on No. 9 the land is very good grazing land, being red marl on the lias; on No. 10 the land is strong clay on the new red sandstone formation; on No. 11 the land is alluvial and rather rich; on No. 12 the land is rather heavy; No. 13 is a factory receiving cream from a large area round; and on No. 14 it is a stiff poor clay.

11970. I believe your attention was specially directed to the peculiar results that were obtained on two of these farms, the Midland Dairy Institute and the Garforth Farm?—My attention was especially directed to those two.

11971. Did you receive instructions during the periodic inspection of those schools which are within your ordinary duties to make inquiry into any facts that might bear upon the very peculiar results shown in these analyses?—That is the case.

Mr. A. E. Brooke-Hunt.

21 Jan. 1903.

11972. What was the feeding at the Midland Dairy Institute, so far as you were able to learn?—During the whole of the summer of 1901 the cattle were at grass, receiving in addition 3 lbs. of mixed linseed and decorticated cotton-cake, which was the ordinary diet for the cows at that institute.

11973. Was that the diet throughout the summer—was it not increased in the month of August, and was there not a further change made in October?—The total amount was increased to 4 lbs. in August, and as the herbage was getting short after the summer 8 lbs. of hay was added in October.

11974. Were any experiments being conducted during that summer on any of the cows that were used?—No, none whatever, that I am aware of.

11975. Had all these cows been in the herd for some time, or were they new animals that had been brought in?—They had all been in the herd some time, I believe, and as far as I am aware they are in the herd at the present time.

11976. Was the practice of feeding them different in that year from what it had been in previous years, or had there been a practice of feeding them so?—This was the ordinary practice; there was no difference.

11977. Was there anything peculiar in the season of 1901 to which your attention was called at these farms when you visited them?—Yes; it was reported that the season there was particularly hot and dry.

11978. Can you give the months that were particularly hot?—From July to September—chiefly August.

11979. You have certain figures as regards the butter fat in the milk at the Midland Institute?—Yes; they were furnished me at the time when I made the inquiries, and gave a percentage of butter fat in the milk of the whole herd, varying from 3·5 in June upwards to 3·8 in October.

11980. Was there any peculiarity in their making of butter?—Nothing whatever.

11981. Did they use a starter?—They do at the Midland Dairy Institute.

11982. There is nothing else that you have to say about the Midland Dairy Institute practice in that summer?—Nothing whatever. It is an exceedingly well-conducted institute.

11983. What was the practice of feeding at the other farm, Garforth?—There also the cattle were at pasture during the summer. There they received from 2 lbs. to 3 lbs. of decorticated cotton-cake per head per day. They received this until the middle of August, when a change took place in their diet; two of them then received 28 lbs. of brewers' grains each instead of this other food, one received 6 lbs. of maize meal, one received 4 lbs. of gluten meal, and the remaining two cows received the cotton-cake as usual. By October, however, all the cattle had reverted to the 3 lbs. of cotton-cake per head.

11984. The weather was the same as at the other place, I suppose?—It was the same—exceedingly hot and dry.

11985. As to the character of the milk as denoted by the butter fat, was it somewhat similar to the other, or was it less good in quality?—It was very similar indeed—perhaps a trifle less good, 3·28 in July and 3·35 in August; the figures show very little difference.

11986. Was a starter used in that case?—No, there was no starter used at the Garforth Farm.

11987. Your attention was called by myself to Mr. Lewin's suggestion that there was something very exceptional in the management of the Midland Dairy Institute and of the Garforth Farm which would probably render the figures so exceptional that they could be left out of our account in considering the results?—That was so.

11988. It is suggested that there was some more or less extraordinary treatment. Did you find on examining the people there that any peculiarity of treatment occurred?—No, most certainly not; there was no extraordinary treatment whatever.

11989. You mentioned Mr. Lewin's figures to them, I suppose?—Yes.

11990. Did they venture on any explanation, for instance, of the figures of 19·4 and 19·9 obtained from the mixed herd and from single cows at Garforth in October; or of the figures of 21·7 in the next month of November, and 22·4 and 22·3 in the preceding months at Derby? Had you any explanations offered on the spot of those figures?—No, they were totally unable to give any explanation. Their only idea in each case was that it might possibly be due to the extraordinarily hot summer. At the Garforth Farm it was suggested that, as the animals were practically steadily and simultaneously going down in their period of lactation, that probably had something to do with it. Beyond those suggestions nothing whatever was given as the reason for it.

11991. As a matter of fact, can you tell the Committee whether there were any experiments conducted either in that year or in the previous year upon the same cows which could possibly have had any effect upon the character of the milk they produced?—There were none.

11992. Neither feeding experiments, nor experiments to show the nature of milking to the students, nor anything peculiar, beyond what happens on an ordinary farm?—There was nothing whatever carried out on those farms which would not be carried out by an ordinary farmer.

11993. Was there anything peculiar in the making of the butter?—Nothing whatever.

11994. Have you any information as to the difference in the character of the breeds of cattle at the farms on the list?—Yes, the herds consist of red polls, Jerseys, black Welsh cattle, and shorthorns.

11995. Can you mention what are the breeds at each particular farm?—At No. 2, in Mr. Lewin's table, the cattle are red polls; at No. 3, the cattle are also red polls, and the milk there is reputed to be of an exceptionally good quality.

11996. Do you know the nature of the food that Mr. Garrett Taylor gives his stock at No. 3; can you tell us whether there is anything peculiar about it?—When I visited the farm the whole of the cattle were at pasture in a field which is irrigated with Norwich sewage, which was then flowing round the field.

11997. Was there a great deal of grass growing?—Yes, there was plenty of grass, and the cattle seemed exceedingly healthy.

11998. Have you had brought to your notice a letter written by Mr. John Speir in answer to Mr. Gilchrist (a member of this Committee), explaining, or endeavouring to explain, the peculiar features of his farm?—Yes, I have had the opportunity of seeing that letter.

11999. Does he also suggest that a method of feeding something in the nature that you now suggest obtained in the case of his farm, namely, a quantity of grass, heavily manured cabbages, and sewage-grown Italian rye grass?—Yes, he does suggest that.

12000. The results on that farm would not be comparable with Mr. Garrett Taylor's results?—No, they would not be. Of course there was a different breed of cattle there.

12001. They would be Ayrshires on Mr. Speir's farm, and, therefore, the results would not be comparable with the results from red polls?—That is so.

12002. Have you anything to tell us about No. 4?—At No. 4 they had a very high-class herd of pure Jerseys.

12003. I believe you are very well acquainted with that herd, as you were at one time in charge of this property at Barnet?—Yes, I was.

12004. What were the cattle at No. 5?—There they were very good class Cumberland shorthorns.

12005. Do you visit that county farm officially?—Yes.

12006. Can you tell us what is the practice there; is it similar to the practice at the Midland Dairy Institute and at Garforth?—I should say it is almost entirely similar, though as the pasture there is somewhat rich, I doubt whether they give the cattle any additional food in the summer. They are turned out in the same way there as they are in the Midlands.

12007. The weather would not be very different there, would it?—The weather, if anything, would probably not be so warm.

12008. Were the cattle there entirely shorthorns?—Yes.

12009. I suppose you mean they were not pure shorthorns, but that they were crossed?—They were not pedigree shorthorns, but were good ordinary dairy shorthorns—the characteristic cattle of that district.

12010. At No. 6 they have the ordinary dairy shorthorns?—Yes.

Mr. A. E. Brooke-Hunt.

21 Jan. 1903.

12011. At No. 7 they have a very well known herd; you know it by reputation possibly?—I know it by reputation, but I have never visited that place.

12012. It is reputed to be a particularly well-managed dairy, is it not?—It has a very high reputation indeed.

12012*. What were the cattle elsewhere?—At No. 8 they have Welsh black cattle; at No. 9, the herd are pure-bred Jerseys; at No. 10 they are the ordinary dairy shorthorns, and at No. 11 half are red polls and half shorthorns.

12013. At No. 11, I believe the experiment did not continue very long?—No, it was only carried on for a short period. No. 12 is a small farm near Gloucester, and there they have a small herd of very good ordinary dairy shorthorns. At No. 13, the milk is received from a large area; the cattle of the district are mostly either Galloways or blue-greys. At No. 14, there are two herds, one pure-bred Jerseys, and the other shorthorns.

12014. No. 14 is another County Council farm, is it not?—Yes.

12015. Were there any experiments going on there?—Not with the feeding of the cattle, beyond giving them additional food in summer, as far as I am aware.

12016. Do you know whether the weather in that part of the country was different from what it was in the North and Midlands?—It would not be so exceptionally hot, I should say, as it was either in the Midlands or in the north of England that year.

12017. The cattle there would be somewhat similar to the cattle in the East and West Ridings farm at Garforth, would they not?—So far as shorthorns were concerned, yes.

12018. How would you group the two sets of figures which are given in the 14 English places in Mr. Lewin's table; first, how many of them represent the ordinary dairy shorthorns?—The ordinary dairy shorthorns come from Nos. 1, 5, 6, 7, 10, and 12. I should say that in considering the milk from that class of cattle these farms only should be considered; and No. 1 I should suggest should be excluded, because very few samples were sent in from that farm, and those were not sent in at the hottest period of the year.

12019. Do you know whether the authorities either at Garforth or at the Midland Institute made any experiments themselves during last summer after hearing of these results, in order to check them?—Yes. Mr. Golding, the resident chemist at the Midland Dairy Institute, did make some tests during last year.

12020. Have you got the results?—Yes.

12021. What were the experiments? Were the same cows taken that were used for the original samples?—With one exception they were the same cows as those from which the milk was taken in 1901.

12022. What was the result?—Mr. Golding tested the butter by the Reichert-Wollny method, and the results he obtained were, in June, 1902, 25·96, in July, 23·92, and in September, 21·56.

12023. You would not call the summer of 1902 a warm and dry summer, would you?—No, certainly not.

12024. Was the feeding the same?—Yes.

12025. Is it then your deduction that, from three-fifths of the ordinary shorthorn dairies the samples taken showed, either accidentally or otherwise, a low Reichert-Wollny number in comparison with the rest?—Yes, that is the case.

12026. (*Mr. Gibbons.*) With regard to the Garforth farm, it seems that they have only six cows; would you think that any reliable evidence could be obtained from a dairy so small?—There are more than six cows at the dairy; indeed, it is a fairly large herd. It means that only six cows were specially selected.

12027. That would come to the same thing; you only get evidence from six cows?—Exactly so; you are taking there the evidence of a portion of the herd.

12028. What breed were they?—Shorthorns.

12029. (*Mr. Gilchrist.*) Are you satisfied from the information you got, that the low Reichert-Wollny numbers for the butter made at those farms have not been due to any special circumstances arising from their being dairy institutes or experimental farms?—I could find no special circumstance whatever, though I searched diligently for it.

12030. A previous witness has told us that low Reichert-Wollny figures can be prevented by good methods of dairying; so far as your experience of these farms has gone, do you think the system of dairying there adopted could be altered so as to give higher Reichert-Wollny numbers?—Of course it is possible that in a dairy you might, so to speak, pamper the cows, and keep them under such unnatural conditions that for aught I know to the contrary the Reichert-Wollny numbers might be materially increased; but that could not be if they were kept under natural conditions, and I hold that these cattle were kept under perfectly natural conditions all through the summer.

12031. Then, in your opinion, it would be a hardship to be obliged to keep cows under the conditions which you have said are necessary so as to produce higher Reichert-Wollny numbers?—It would be extremely inconvenient, I should say.

12032. (*Mr. Anderson.*) I should like to ask you whether the system of manufacture has anything to do with the variation of the Reichert-Wollny number?—The system of manufacture at all these institutes is precisely the same as at any other institute or well-conducted dairy farm in the kingdom, so far as I know.

12033. For instance, is the cream artificially ripened?—It is kept, of course, for a certain period. In one case a starter is used, and in the other it is not.

12034. Did you notice any difference between the results where the starter is used and where the starter is not used?—No.

12035. What was the kind of starter used?—I cannot tell you.

12036. Would the length of time at which the butter was kept after it was made, have any effect on the variation of the Reichert-Wollny number?—I cannot state that it would.

12037. (*Sir Charles Cameron.*) Do you know of any experiments with regard to the feeding of animals which conclusively show that by peculiar feeding the amount of volatile fatty acids can be increased in the milk?—No, I have not been concerned with that point.

12038. Might it happen that that exceptional feeding would depress the amount instead of increase it, so far as you know?—I do not profess to have any knowledge upon the subject.

12039. Do you know of any experiments that prove that we may increase the amount of volatile fatty acids?—No, I do not. I was simply inquiring into the manufacture of the butter from these different farms.

12040. You are of opinion, I gather, that the data so far obtained would not justify any standard whatever?—I should think the evidence from these farms is not sufficient to base a standard upon.

12041. Are you aware that there have been hundreds of convictions based on the Reichert-Wollny standard, in which there has been no attempt at defence made at all by the manufacturers of the butters?—I am not aware that that is the case.

12042. What procedure could be taken with regard to detecting adulteration?—It is not my province to state that in the least. I have no opinion.

12043. If no standard whatever can be fixed, how could any proceedings be taken to ensure the quality of the butter?—My sole point here is that the tabulated experiments conducted have not been sufficient to enable us to arrive at any definite conclusion.

12044. Do you say that no standard can be fixed?—That would be the result of my observations on these farms.

12045. Your opinion has reference only to that?—Yes.

12046. I thought it was a general opinion having regard also to what you had read on the subject?—Not at all.

12047. (*Mr. Dunn.*) Two instances of low Reichert-Wollny numbers have been mentioned as occurring on the Garforth farm—namely, 19·4 and 19·9; do I understand you to suggest that the explanation there was the heat?—I could not give any explanation. I have only mentioned that the summer was an exceedingly hot and dry one; whether that had any effect upon the Reichert-Wollny numbers or not, it is not for me to say.

12048. These two low numbers appear to have been obtained in the month of October, when the heat would possibly be moderate?—Yes, that is so.

12049. You appear to have made up your mind that the shorthorn cattle give lower figures than some of the others; is that so?—So far as these particular figures are concerned, they apparently do.

Mr. A. E. Brooke-Hunt.

21 Jan. 1903.

12050. I do not think you have investigated any of the experiments conducted in Scotland or Ireland?—No, my duties only take me over England and Wales.

12051. (*Chairman.*) I think you have not mentioned one factor that is often taken into account by witnesses—that is, the period of lactation?—The cattle from both the Midland Dairy Institute and the Garforth Farm were gradually going down in their period of lactation, and they were, I believe, with only one or two exceptions, the same cows throughout until quite late in the autumn.

12052. In your inquiries did you take into account the period of lactation, and in the case of a very low number, did you ascertain whether it was obtained near the end of the period?—In these two cases the cattle, so far as I remember, had calved about the beginning of the year; consequently, by the end of the year they were all very nearly at the end of their period of lactation. All that information, I think, Professor Thorpe has on the returns which were furnished from the farms. I am now speaking simply from memory.

12053. (*Professor Thorpe.*) It is the fact, is it not, that cows which did give these low numbers were in an advanced period of lactation, and were stale, and going off?—I believe so.

12054. Having regard to that, the results were in general accord with what we invariably find—namely, that when cows are approaching the end of their period of lactation, the Reichert-Wollny number, and the amount of volatile acids goes down; that is a pretty well ascertained fact, is it not?—Yes.

12055. In that sense there is nothing exceptional there?—Quite so; but they would be representative of a very large number of herds of the country in that respect.

12056. Butter, as we eat it, is not produced from cows all of them invariably in an advanced period of lactation, but it is produced from cows in all sorts of periods of lactation; and, therefore, you cannot argue as to the general character of butter so produced from what an individual cow gives at an advanced period of lactation?—That may be so.

12057. (*Major Craigie.*) Mr. Lewin, in answer to Q. 10640, told us that the experimental courses carried out at these institutes had seriously affected the capacity of the herd to produce normal butter-fat; was that point specially put before the authorities when you went there, and were they informed that it had been suggested in evidence before this Committee that their butter was very low in butter-fat?—No. I do not think that was specially put before them. For my own information I got them to give me what the percentage of butter-fat was, thinking it might possibly have some bearing upon the question.

12058. Are those figures kept up regularly; do they, as part of their regulations, go into the chemical composition of the butter from time to time and test all these matters?—Yes, as regards the percentage of butter-fat.

12059. Do they as regards the Reichert-Wollny numbers?—No.

12060. They do not, as a matter of fact, ascertain the Reichert-Wollny numbers regularly as part of their business?—I think not. They might occasionally.

12061. Have they back records that they could produce for other years?—They have of the butter-fat, but not of the Reichert-Wollny numbers.

12062. (*Professor Thorpe.*) I believe the chemist at Garforth Farm is Mr. Herbert Ingle?—That is so.

12063. He has published, has he not, a little pamphlet upon the variations in the amount of butter fat in the milk of the cows at Garforth?—I believe so.

12064. Have you seen that?—I am familiar with the small pamphlet which they publish from the Garforth Farm.

12065. The Garforth cows, although they appear to be normally fed, so far as we know, are somewhat singular in producing a rather lower amount of butter fat than is usual?—Is that the case? They give a rather low butter fat, no doubt; but, taking the herds of the country similarly situated—similar land and similar herds—would you find them the same, or would you not?

12066. That is the whole point about the Garforth Farm. This came out very clearly in the evidence that was presented to the Committee on Milk Standards. It was first brought out by the chairman of that Committee, Lord Wenlock, who was quite familiar with the circumstances of the Garforth Farm. Garforth Farm sends a certain quantity of its milk, I believe, to Leeds, and its milk is exceptional in the relatively small amount of butter fat which it contains. That circumstance was in Mr. Lewin's mind when he made the remark which has been quoted by Major Craigie. Whether it be the feeding or whether it be the nature of the herd, or whether they be experimented upon, or what not, I cannot say, nevertheless the fact does stand out clearly that the Garforth cows do give an exceptionally low quantity of butter fat?—Lower than would be got from other farms over the whole of the West Riding of Yorkshire or Lancashire?

12067. Certainly?—Have a sufficient number of experiments been conducted all over that district to demonstrate that?

12068. We had a good deal of evidence from adjacent parts—I cannot call to mind now precisely where they were—and that fact stood out very clearly; and that has been emphasised, in a way, by the publication by Mr. Ingle of his results. The point that struck us in considering these results was whether the circumstances whatever they might be, which led to the production of a low quantity of butter fat in the milk also led to the production of a butter fat containing a relatively small quantity of volatile acids—in other words, whether the deficiency in the butter fat was caused by the absence of those glycerides which characterise the Reichert-Wollny number. The other analyses which we have made of these butters—namely, the determination of the Hubl number and the determination of the Hehner number—do serve to account for the changes in the Garforth milk. We have, as a matter of fact, a higher proportion of olein in the Garforth numbers—that is to say, we have a higher Hubl number and we have a higher Hehner number. Therefore there has been some condition which has tended to produce in the Garforth milk fatty acids of a different order from those which are produced under normal conditions. But you have thrown a great deal of light on the whole question when you say that these cows giving these low Reichert-Wollny numbers were approaching the end of their period of lactation; in that sense the results shown are normal, are they not?—Quite so.

12069. (*Mr. Gilchrist.*) Do you know whether, at such farms as Garforth and the Midland Dairy Institute, they are selling their butter fresh daily—not cured and potted?—As far as I know, it is all sold fresh.

12070. Is it not the case that they are keeping up a quantity of butter for their customers all the year round?—Yes.

12071. I notice that in Mr. Lewin's table there are samples of butter taken in every month; as you are aware, it is usual on farms where butter has to be supplied all the year round, for the cows to be brought in to calve at intervals, in order to keep up the supply?—Certainly.

12072. If that be so here, then these cows would not be all at the end of their period of lactation?—All the cows in the two herds would not be, but the selected cows from which these particular samples were taken, practically speaking, were so. I am speaking entirely from memory now, but I think there was one introduced into the set at Garforth Farm; however, the whole of those particulars have been furnished to the Government Laboratory.

12073. (*Professor Thorpe.*) What you imply, if I understand you, is this; that in the month of October the cows at Garforth which gave Reichert-Wollny numbers of 19·4 and 19·9 respectively, were in an advanced period of lactation?—One of those lines of figures refers, I believe, to the whole of the herd, in which case, as Mr. Gilchrist has pointed out, other cows would have been brought in, and there would have been fresh cows calving from time to time in order to keep up the quality of the milk. But in the case of the particular six that I have been speaking of, they were all gradually going down, and were getting towards the end of their period of lactation; yet you get pretty nearly the same results in both lines.

12074. (*Mr. Anderson.*) Would that not be more apparent in the next month, November, when I see the numbers were 23·4 and 23·3 respectively; those six would be still further advanced in their period of lactation then?—Yes. As I have said, all these particulars have

Mr. A. E. Brooke-Hunt.

21 Jan. 1903.

been furnished in the returns to the Government Laboratory.

12075. (*Professor Thorpe*). There was something which you have told us which we had not before. For instance, we had no knowledge of the state of the herbage or of the character of the season?—Quite so, but the numbers of the cows and their dates of calving appear in the returns supplied to the Laboratory.

12076. (*Major Craigie.*) With reference to what Mr. Ingle has written before on this question, speaking partly from memory and partly from one of his pamphlets which I have here, I remember that he has laid stress on the great variations between the morning milk and the evening milk at Garforth, as showing a wider range than is found in most parts of the country. That point Lord Wenlock also brought out before the Milk Standards Committee. You know something about their times of milking; can you tell us whether there is anything peculiar about the hours of milking at Garforth?—I know of nothing peculiar. I have seen them milk in the evening at the ordinary time, but I have not seen them milk in the morning.

12077. Do you think there is not a very long interval between one milking and another which might produce this great variation?—I do not think so. They milk at the ordinary time in the afternoon, between 3 and 4.

12078. (*Professor Thorpe.*) A point which we cannot understand, and never could understand, about Garforth is that while the average percentage of fat was 2·69 in the morning's milk, in the evening's milk it was 4·03. If the cows were milked at fairly regular intervals—that is to say, if the whole period of 24 hours was divided into fairly regular intervals, then, in the light of all we have got to know, such a variation could not obtain; is that not so?—As far as I am aware, they are milked at exactly the ordinary periods, twice a day.

12079. (*Mr. Gilchrist.*) With exactly equal intervals between?—There are not two exactly equal intervals, I presume. The morning's milking takes place at six o'clock probably, and the evening's milking certainly takes place to my knowledge at about four.

12080. (*Professor Thorpe.*) That is very much the ordinary time of milking?—Quite so.

12081. Yet we never get such variations under ordinary conditions as those between the morning's and evening's milk at Garforth?—It is beyond the power of explanation, so far as one's knowledge of the farm is concerned.

12082. (*Major Craigie.*) Whatever happens at Garforth, there is nothing of the same sort happening at the Midland Dairy Institute, is there? So far as I know, there is no statement of great variations, such as Mr. Ingle mentions here, published in connection with the Midland Dairy Institute?—There is nothing of that kind published.

12083. Do you know at all what the case is there?—I am not aware that they have any similar experience to Mr. Ingle's, but then I do not know that they have tested their butter in the same way. It is perfectly possible to have the point systematically tested all through the season at every dairy institute, if it were deemed desirable.

12084. I believe you have been at the Colonial College, Hollesley Bay?—I have.

12085. Do you know anything of their system, and can you tell us whether they have any records of that sort?—I do not know whether they have or not.

12086. (*Mr. Gilchrist.*) Will you look again at the figures of the Midland Dairy Institute? I find that almost the lowest there are 22·5 in July, 23·5 in August, 22·4 in September, and 22·3 in October. In your opinion, do these figures point to the period of lactation as having anything to do with the lowering of the Reichert-Wollny number?—That I really cannot say. I can merely state the fact that, as far as I know, these cows were all the same with the exception, I believe, that one fell off and another one was put in.

12087. (*Mr. Gibbons.*) In the case of No. 14, which is the Somerset County Council farm, there is a great difference between June and July. In June the Reichert-Wollny number is 29·6, and a few weeks after it is only 26·8; then in November (and I suppose from that to December there would be very little variation in the cows) you get 26·5, and in December 29·4. I know that place; they have only a few cows there, and I think there would not be very much difference in the period of lactation there?—No, there probably would not.

12088. Yet we have those wide differences to which I have referred; can you explain them at all?—I cannot.

M. Kalantar, called; and Examined. M. Nicholas Smirnoff, Secretary to the Russian Imperial Financial Agency, acted as Interpreter.

M. Kalantar.

12089. (*Chairman.*) We understand that you have come over to appear before this Committee as the delegate of the Russian Government?—Yes.

12090. Will you kindly state what official position you hold in Russia?—I am the "Chief Specialist" under the Government in regard to butter analysis.

12091. You appear here then as a chemical expert?—As a chemical expert and also as an agricultural expert.

12092. Will you please state in what parts of Russia the Russian Government is endeavouring to develop the butter industry?—In the northern provinces of European Russia and in Siberia, on the route of the Siberian Railway.

12093. (*Professor Thorpe.*) Would you kindly indicate more precisely the eastern area?—Tobolsk, Omsk, Tomsk, and Kourgan.

12094. (*Chairman.*) Will you now please describe the steps which are being taken by the Russian Government to develop the butter industry?—In the first place, Government instructors are sent all over the country to teach the people the best and most profitable way of turning milk into butter. Then, secondly, there are special courses at the schools for teaching people who have already learnt to make butter in the old way, to make it in a quicker and more up-to-date sort of way. Thirdly, there is the development of railway transport. Over 1,000 new cars have been made which are sealed at their starting place, and are not opened until they get up to Riga. The butter is kept at a temperature below freezing, and carried in refrigerating chambers, and the ice is continually changed at the stopping places. Six large laboratories have been established in Siberia for the examination of the butter which is made there, and there are also three similar laboratories in European Russia.

12095. I understand that the Russian Government has taken some steps in connection with the inquiry which this Committee is making; will you please inform us what analytical work has been done?—The Government has collected samples of butter from all over European Russia and Siberia, and has submitted all those samples to examination at the Chief Laboratory in St. Petersburg. All these samples have been analysed in exactly the same way, and the results have been tabulated. In order to secure that the samples should not be tampered with, Government inspectors were sent to the various localities, and with their own private seals sealed up the samples, and sent them to the Chief Laboratory in St. Petersburg.

12096. What enquiries were made in the case of each sample as to its previous history; in other words, what enquiries were made as to the breed, feeding, and care of the cattle, and so forth?—It was easy to find all that out in the case of the samples collected in European Russia. Each sample was accompanied with an official document, stating the breed of the cow, and the way it was fed. But that was not possible in the case of the Siberian butter, because that is made from milk collected from different districts. Of course, in Siberia the general average breed, the average feeding, and the average health of the herds could be ascertained; and that information was sent.

12097. Is the Siberian butter mostly produced in creameries?—Yes.

12098. How are these creameries owned and organised, are they owned by individual proprietors, or by associations?—The majority are in the hands of private people, but there are a good number of them held by associations.

12099. Are the associations joint stock companies of capitalists, or are they associations of farmers?—They are associations of farmers, not capitalists.

M. Kalantar.

21 Jan. 1903.

12100. Are they what are known in this country as co-operative societies of farmers, similar to the co-operative associations in Denmark, for instance?—Yes, it is exactly the same thing.

12101. Would you describe generally the method of analysis, and the various tests employed?—The method is described in the synopsis I have prepared, and the results are shown in the tables I have sent in. (See Appendix, No. XXXII.). Since preparing my synopsis I have been able to add 150 later analyses.

12102. (*Professor Thorpe.*) Does the subsequent information obtained from those 150 analyses materially affect the conclusions arrived at in your synopsis?—Those 150 anayses only, so to say, give fuller evidence of the fluctuation. The first (on the left hand side) of Table B gives the history of the butter, where and when it was made, and so forth; and on the right hand side I give the analyses which were made at the Chief Laboratory at St. Petersburg. There were ten different divisions in the analyses, as you can see from the top of the table on the right.

12103. (*Chairman.*) I wish to say about these tables that you have handed in, that we appreciate very highly the work that has been done by the Russian Government to aid the British Government in trying to arrive at a right conclusion for the good of our own trade and theirs. We would like you to express to your Government our sense of the good work that has been done by them, and of great assistance it is to us. I wish now to ask a few questions on the general conclusions which have been arrived at. As I understand, you are very anxious, in the interests of the Russian trade, that some effective method should be found of detecting fraud?—Yes. Of course, that is a matter of grave consequence to the Russian Government, and the Russian Government has taken steps in that direction. Of course, acting alone, it cannot hope to be successful, and it would like to have some sort of joint action—either through a Committee, or a Conference, which would investigate and decide upon the measures to be taken.

12104. After considering all the known tests which can be applied for discovering the genuineness or otherwise of butter, as I gather, you are of opinion that none of them can be relied upon as a public test?—Up till now no chemical or physical way of analysing butter has been arrived at, by which you can really decide whether the butter is adulterated or not.

12105. The reason being that during certain months of the year the butter is naturally of so much lower quality, that a test that would apply to the other times of the year would not apply then at all; so that you would be obliged to have certainly two tests?—Yes, of course. The methods of analysis must be the same, but there should be different standards for the summer butter and for the winter butter. Up till now we have not been able to discover a standard which could be applied both to summer butter and to winter butter, but perhaps it may be discovered in the future.

12106. The Reichert-Wollny number of 24 has been suggested to this Committee by many witnesses; suppose that number were taken, what percentage of the Russian butter would be injuriously affected by such a restriction?—If the Reichert-Wollny figure was fixed at 24, then it would affect about 30 per cent. of our average winter butter, and about 15 to 20 per cent. of the butter produced all the year round. Of course, it depends upon the temperature. One year is colder than the average, and another year is hotter. In a hot year, Russian butter would not be affected by the Reichert-Wollny number so much as in a cold year, and the percentage might go down lower still if the year was cold and rainy, as it was last year in European Russia, although in Siberian Russia is was all right.

12107. (*Mr. Gibbons.*) You appear in Russia to have done all you can to increase the value of your butter; but how do you account for the fact that the prices of Russian butter are so low in our markets?—The reason is the distance between England and the different parts of Siberia, the deficient means of transport which existed until quite recently, and the manner in which the butter used to come over. It used to take about six weeks; in the summer the temperature would, of course, change during that time, and that would affect the quality of the butter. Latterly, however, the Russian Government has taken measures to improve the means of transit, and as soon as these railway cars with refrigerators were brought into use the butter came over in much better condition, and prices rose accordingly.

12108. I am talking of the prices of Siberian and Russian butter to-day. We have before us this fact, that the distance from Siberia to England is not at all comparable with the distance from New Zealand and Argentina?—From New Zealand it does not come over in railway cars, it comes in steamers, and travels all the way in refrigerators. Up till quite lately butter did not come from Siberia in refrigerators, and it is only within the last few years that refrigerators have been made, and that the conditions have been the same as those connected with the transit of New Zealand butter.

12109. But as I have said, I am taking the Siberian and Russian butters of to-day?—There is also this fact, that although the summer butter that comes from Siberia is chemically and to the taste better than the winter butter which comes over in a harder state, yet the winter butter commands a higher price than the summer butter.

12110. It is your winter butter at its present price to which I am referring?—That can be explained. The measures that we have taken are not so full and complete yet as the measures that have been taken in New Zealand and Denmark. Even now when the butter starts from Siberia it is not cool enough, as we have not got cold storage all the way from the starting point. If it comes over that distance, and then is put into a refrigerator or a cold store in London, the butter is delivered in quite a different condition to what it would be if it were put into cold storage at the very first and sent all the way in refrigerators. The Russian Government therefore is now taking measures to have cold stores made in Siberia, so that the butter can be frozen there, and can be put into the refrigerating cars in a frozezn state, and can in that state, without change, travel over the 5,000 kilometres from there to England.

12111. I was under the impression that the butter does not require to be artificially frozen as the climate itself does that naturally?—In the summer it is much warmer in Siberia than it is in London.

12112. Do the present prices of Siberian butter in England give a profit to the Russian farmer?—Yes, because the higher the price for the butter here, the higher the price for the milk out there. As a fact, in the last ten years the price of milk has risen in Siberia.

12113. Do you fear that margarine is incorporated with your butter in Russia?—No, it is never added, because it is more expensive to make margarine in Russia than to make natural butter. There are only two margarine factories throughout all Russia, which make about 120,000 cwts. of margarine. Further, it is prohibited by Russian law to import margarine into Russia. If margarine were to be transported from the factory at Moscow to Siberia for the purpose of adulterating butter, the price then of the artificial butter would be higher than that of the natural butter. It is therefore not worth while adulterating it.

12114. (*Chairman.*) What steps does the Russian Government take to control the manufacture and sale of margarine?—At each of these two factories, which are situated at Odessa and Moscow respectively, there is a Government inspector always on the premises; a fixed quantity of margarine is packed up in a certain way, stamped in a certain way, and put into a certain box, which is also stamped; and further, the law requires that the package must be clearly marked, showing that the product is margarine, and nothing else. There is a law prohibiting the mixing of margarine with butter and enacting a punishment. Such admixtures are not allowed in any part of the country.

12115. Has the Government found it necessary to have some substance incorporated with margarine in order that it may be detected in admixtures?—No, the Russian Government has not done that.

12116. (*Professor Thorpe.*) In the event of anything like an international control over butter being established, have you reason to believe that the Russian Government would be willing to conform to the methods adopted in Germany and Belgium, and to insist upon the incorporation of some tell-tale substance in the margarine?—The production of butter in Russia is even more than a hundred times larger than the production of margarine in Russia. Of course, I cannot answer for the Russian Government, but I am almost certain that it would take steps in the way of adding something to margarine, so that it could always be traced, if an international congress on this subject were to agree to such a course being adopted.

12117. Are you familiar with the process of making margarine in Russia?—The whole method of preparing and manufacturing margarine in Russia is strictly laid down by law, and the margarine factories in Moscow and Odessa must follow that law.

12118. Does that law prescribe the kind of vegetable oil with which the margarine may be made?—I recollect that the law says you cannot add to margarine more than 10 per cent. of cream. I will bring the law with me to-morrow.

12119. (*Mr. Gibbons.*) Is it a fact that it costs more to produce margarine in Siberia than it does to produce butter?—Margarine is only manufactured in Moscow and Odessa; there are only those two factories in Russia.

12120. But might it not be imported into Siberia from other parts of Russia?—It could only come from those two parts.

12121. Would the cost of margarine in Siberia be greater than that of butter?—It would not be any good to a person to import butter into Siberia, because to carry a hundredweight of margarine from Moscow to Siberia would add about 10s. to its original price, and from Odessa the cost of transit would be still more.

12122. Could you detect the presence of, say, 7 per cent. of margarine added to butter by any process you now have?—No.

12123. What would be the lowest percentage that you could detect?—There are really no chemical means of detecting it. Even if you were to add 200 per cent. of margarine to summer butter which has a Reichert-Wollny figure of 32, it would be impossible to detect it, because then that would only produce a Reichert-Wollny figure of 26·5.

12124. Do you say that the period of lactation interferes with the proportion of fatty acids in butter?—Yes, to a very great extent.

12125. You say it reaches its minimum in the autumn, but how can that be when the cows calve, as you say, from January to March?—The first reason is that the period of lactation comes to an end about that time; and, secondly, the cows are then still out in the open, and it is very damp and cold at that time.

12126. I am talking of the autumn?—I am referring to that time; they feed in the open then.

12127. (*Mr. Dunn.*) I think you said that 30 per cent. of the winter Siberian butter would be affected by a Reichert-Wollny standard of 24?—Yes.

12128. What per cent. of all the butter of Siberia would be affected by that?—The average would be from 15 to 20 per cent., taking it all the year round.

12129. (*Mr. Anderson.*) Could you give us a brief description of the system of making butter in the co-operative creameries in Russia?—The milk is brought round from peasants who have herds of cows; it is weighed at once and filtered; then all the different milks are mixed together, and then the butter is made.

12130. Is the milk paid for according to the percentage of butter fats which it contains?—No, the payment is according to the weight of the milk. Up till now there has been no attempt made to pay according to the percentage of butter fat, but now that we have instructors in the laboratories in Siberia we are on the eve of taking that step.

12131. Then, in the case of these Russian creameries, it would pay a farmer better to supply a large quantity of poor milk than a comparatively small quantity of rich milk?—Of course it would be better to pay for a smaller quantity of milk with more butter fat.

12132. My question was put with the object of finding out what inducements are offered to the Russian farmers to feed their cows well and take good care of them, so as to produce a milk of good quality?—No cows give such rich milk as the Siberian cows. The cows on the Altai Mountains give 7 per cent. of fat; in Tobolsk we get 5 per cent., and in Yaroslav 4·4 per cent.

12133. Is that the average percentage of butter fats throughout the year?—Yes.

12134. How are the cows fed?—They are fed differently; but on the whole the way in which they are fed is very unsatisfactory—it is not bad, but at the same time it is not satisfactory.

M. Kalantar.

21 Jan. 1903.

12135. As I understand, the system of paying for the milk according to the quality is not yet adopted by the Russian creameries?—Not as yet, but it will be brought into operation soon.

12136. Hitherto it has not been the custom?—No. The milk is, of course, examined for the butter fats, but the peasants have not been paid according to the butter fats up till now; they have been paid upon the weight of the milk.

12137. (*Professor Thorpe.*) With, of course, the option on the part of the purchaser of rejecting a poor milk; he would turn away a peasant who brought him a milk of a very low quality, would he not?—Yes, and they very often do reject a milk which is poor.

12138. (*Mr. Anderson.*) Is that the case with the proprietary creameries?—It is the case with the associations; not with the private ones.

12139. In the case of proprietary creameries, is there a system of paying for the milk according to the percentage of butter fats which it contains?—No, there is not.

12140. Can you give us any information as to the cost of production of butter in Russia?—Are you referring to the prices of Russian butter in the Russian market only.

12141. What I want to find out is whether butter is produced more cheaply in Siberia and in other parts of Russia than butter is produced in this country?—There is a great difference; it is much cheaper in Siberia.

12142. So that it would not pay the Siberian manufacturer to mix margarine with his butter?—No, not a bit.

12143. As regards transit between Russia and England, can you give us any information as to what the cost is per cwt.?—It depends what part of Siberia you take, because Siberia is so extensive.

12144. Perhaps the better way to put the question would be to ask you what is the cost of the manufacture of a cwt. of butter in Russia, and what is the actual percentage cost of putting that cwt. on to the English market? Your nearest seaport town would be Riga; taking the furthest point of production of Siberia, Barnaul or Minussinsk, what would be the cost from that point to London?—It would be about 20s. per cwt.

12145. (*Professor Thorpe.*) May we take it that the cost of transit is one-fifth of the actual market price of the butter in London?—It is about that.

12146. (*Mr. Anderson.*) Can you say how far the Reichert-Wollny number can be controlled by the butter maker; how far it would be possible, for instance, in the system of making, in the system of cream ripening, and in the system of feeding cows, to control it?—Nobody can do that.

12147. It is stated in the synopsis of your evidence that in some cases near the end of the period of lactation the cows are fed on straw?—That is so. The Reichert Wollny number has to be ascertained scientifically, and the person who has the cow is not a chemist, so he cannot find that out—it can only be found out at the laboratory.

12148. Feeding has a great influence on the quality of the butter, has it not?—Yes, the Reichert-Wollny number does, to a certain extent, depend upon the feeding.

12149. Would you say that the kind of feeding which the Russian cow gets is inferior to the feeding which cows in other parts of Europe get?—Yes. If you take, for example, Denmark, you will find that there the cow is fed better and has richer food. But that has not an effect on the flavour of the butter; although in Russia the food is not so rich and the transport is worse, the flavour of the butter is better.

12150. But may I take it that the system of feeding the cows is capable of a great deal of improvement?—If the improvement were general, of course the quality of the butter would be improved, as it was improved in Denmark and in Sweden; but then I think you would find new faults occurring which had not been found to occur until then.

12151. Dealing with this particular question, would it not be possible to raise the standard of Russian butter by improving the standard of feeding and of the treatment of the cows?—What do you mean by the "standard" in this connection?

M. Kalantar.

21 Jan. 1903.

12152. I am referring to the comfort of the animal; for instance, in a cold, wet climate, to protect the cow from the cold and the wet by providing appropriate accommodation, such as cowhouses?—Of course, that would affect the health of the cow.

12153. Then may the Committee take it that to a large extent it is within the power of the butter maker to regulate the Reichert-Wollny number in the case of Russian butter?—No. Take, for example, Germany, where the cows are kept much better; the same influence of the winter is said to be found there.

12154. (*Professor Thorpe.*) But not to the same extent?—Not to the same extent; but the same fluctuation does take place.

12155. The point is, that it is not to the same extent?—In some of the butters the Reichert-Wollny figure goes down below 19.

12156. I do not know whether you have actually seen the evidence, but we have had the German representatives here, who have given us full information as to the character of the butter in Northern Germany. We have the record on our notes that the butter of Northern Germany is not so very dissimilar from that of many parts of Friesland, from which we also have pretty accurate information as to the number of butters that would be affected?—I do not say all do, but some will go down below even 19.

12157. That may be, but the point, as I understand, that Mr. Anderson was making was that by better feeding and by a better protection of the cows the percentage proportion of butters that would be affected by the imposition, we will say, of a Reichert-Wollny number of 24 would be lessened?—Yes, it would be so, very probably.

12158. (*Sir Charles Cameron.*) I understand that the milk of Siberian cows was a very rich milk?—Yes.

12159. I think I heard you say that it went up sometimes to 7 per cent. of fats, and that the mean was 4·4?—No; the 4·4 was the figure for European butter.

12160. What is the general character of the milk in Siberia from which the butter we are now discussing comes?—In Siberia we get 5 per cent.

12161. Is not that much above the average of other countries?—The 5 per cent. is not above the European figure, but the 7 per cent. is.

12162. It is above the standard in England and Ireland; you are possibly aware that 3·5 is the average here?—Yes.

12163. If the milk produced gives on an average 4·4, how can any improvement be effected, because the quality of your milk is already above that of our country's?—By putting the cow under better conditions you do not raise the percentage, but you get a greater quantity of milk.

12164. (*Professor Thorpe.*) I believe that with the Siberian cow, although the milk is very rich, the volume is not very great?—That is so.

12165. (*Sir Charles Cameron.*) I want to get at the average quality of the milk from which comes the Siberian butter that we are now discussing. Questions have been put with the object of showing that by improving the conditions under which the cows are kept, the quality of the butter might be improved. I take it, with regard to our particular inquiry in reference to a standard, that the amount of fatty acids in the butter that are soluble and volatile might be increased; is the undoubtedly low percentage of the volatile, soluble acids in your Siberian butter due to the fact that there is a larger total quantity of fats in Siberian cows' milk, that excess of fats being, in fact, fats which contain the fatty acids that are not soluble or volatile? This is an important point, I may remind you?—Very likely what you suggest is the case, but this question has never been investigated.

12166. Then, it is not known whether what I suggest is the case or not?—It is not known.

12167. (*Professor Thorpe.*) Perhaps, I might attempt to throw a little light upon this; would you say that the absolute amount of butter fat excreted by a cow per day is not probably greater in Siberia than it is elsewhere, but the relative amount is larger because the total volume of the milk is less?—If we take for example the Yaroslav cows, we find that they are fed much better than the other cows, and they yielded a greater quantity of milk, but the percentage was only 4·4.

12168. Can you tell us what is the average butter yield of the cow, and what are the ranges of variation in Siberia?—The average is from 1,000 to 1,200 litres of milk.

12169. What is the weight of the butter?—About 60 kilogrammes of butter in the summer period; and for the whole year about 80 kilogrammes.

12170. Can you tell us how that compares with the Dutch cow or the Danish cow?—It depends where the Dutch cow is; if it is in Russia it yields less.

12171. I meant the Dutch cow in Holland—in the province of Friesland, for example?—There the yield of the Dutch cow is much larger than the yield of the Siberian cow.

12172. The cow as a butter-producing animal is not richer in Siberia than she is elsewhere, but, probably, she is rather poorer?—Yes.

12173. And the total amount of fat she excretes is really less than a cow excretes elsewhere?—The average sum, of course, would be much smaller.

12174. (*Sir Charles Cameron.*) I have heard now, for the first time, of this extraordinary quality of milk in Siberian cows; I know very well what the average is in nearly all European countries, and the amount of fat stated to be in this Siberian milk is on the average in excess of anything I have ever read of in milk, certainly in Ireland and in England. Have there been any experiments made of a scientific nature to determine whether that excess of fat in the milk of Siberian cows contains all the ordinary constituents of the butter fats in the same proportions as they exist where there is the ordinary amount of fats, namely, 2·8 up to 4 per cent.? I can understand that while low figures might be obtained if the excess of fat consisted, not of the volatile fatty acids, but of the fixed fatty acids, because, then, undoubtedly, we should have low Reichert-Wollny numbers, and in that way some light would be thrown upon the extraordinarily low figures given by the Siberian butter. Is there any determination made as to the relative amount of the volatile fatty acids, not in the butter but in the milk?—The fats that I have mentioned in my synopsis are all those that can be got out with sulphuric ether.

12175. The total fats, in fact?—Yes.

12176. Not differentiated?—No.

12177. Then you have no information on that point?—No.

12178. If you had information, I think it would be of great use to know whether that extraordinary increase in fat was due to an increase in the fixed fats, and not to an increase in the volatile ones. Are suet and lard articles that are well known in Siberia?—They can be obtained in Siberia, but people are not allowed to adulterate butter with them.

12179. I did not ask that; I only asked whether these commodities, suet and lard, are as well known there as butter?—The production of lard and suet, in comparison with the production of butter is much smaller in quantity.

12180. Which is the higher priced in Siberia—suet and lard, or butter?—I could not tell you the exact prices, but I think lard and suet would be cheaper.

12181. Nowadays, it is not margarine that is mixed with butter in order to adulterate it, but it is the materials that are used to make margarine which are generally employed to adulterate butter; what is to prevent any butter manufacturer in Siberia using lard and suet?—All my tables are founded on investigations made by Government Officials, so that the butters in those cases are all right.

12182. Are the manufacturers actually prevented from mixing lard and suet with the butter?—The butter that I have been dealing with is genuine butter; it is not adulterated butter that I have been speaking about.

12183. (*Mr. Anderson.*) Can it be shown on analysis that the keeping of butter for any length of time has any effect upon the percentage of volatile acids which it contains?—To a certain extent it does affect the percentage.

12184. Would you say that it affects it to an appreciable extent?—This question has not been very much investigated, but it has undoubtedly a certain effect.

12185. Could you not tell us to what extent it has an effect?—I cannot give you an opinion about it, because there are so many different opinions on this point. Some authorities give a very large percentage, and some give a very small percentage. This is probably owing to different butters having been taken into consideration, sometimes these butters being summer butters and sometimes winter butters.

12186. Which would be affected most by keeping, summer butters or winter butter?—That is a point which has not been investigated, so I could not tell you.

12187. Is the butter a sufficiently long time in transit to be affected in this way?—To a certain extent the length of the voyage has an effect upon the figure, but to what extent I could not tell you, because it has not been investigated.

12188. I think you have told us that all the butter which you have had under examination for the purpose of your evidence here has been made in creameries, or under the creamery system?—Yes.

12189. In asking you how these creameries were worked, I wanted to know whether the cream was pasteurised before it was ripened; according to the tables, in some cases it was pasteurised and in some not?—What do you mean by ripened?

12190. Is it the rule to pasteurise the cream before it is churned in the creameries?—Yes.

12191. Has that any effect on the percentage of the volatile acids?—I cannot say.

12192. (*Chairman.*) Do you know why the people who sent the samples were asked whether the cream was pasteurised?—It depends upon what market the butter is intended for. If the butter is intended for export, it is pasteurised; if it is not intended for export, it is not pasteurised. If it is intended to be turned into Parisian butter, it is pasteurised very highly. Those butters that are for use in Russia only are not pasteurised, but are made from unboiled cream.

12193. What is the Parisian butter?—That is obtained from very highly pasteurised cream. The Parisian butter in taste reminds one somewhat of Danish butter.

12194. (*Major Craigie.*) Is there any large consumption locally of this butter in Siberia?—No.

12195. Therefore, the larger proportion of the butter made, say, in Tomsk or Kourgan, or any of those places, is made for export?—Yes, nearly all the butter that is made there is for export. On the average, 80 per cent. of it is exported, and the other is made for internal use.

12196. I suppose the district is very sparsely populated?—It is populated all along the rivers.

12197. Take the peasants from whom the butter is collected for the making of that butter, have they been recently planted there—that is, are they immigrants into Siberia from European Russia, or are they natives?—They are both.

12198. Should I be right in concluding that there has been a considerable number of immigrants who have settled near the railway line since it was opened?—Yes.

12199. But this butter industry began before the railway was constructed, did it not?—Before the railway was built there was a large export of melted butter into Turkey.

12200. How was that trade conducted?—A very small proportion of this melted butter was sent along the rivers; the bulk of it was packed into large barrels containing about 3 cwt., or even more, put into sledges and carried up to Nijni Novgorod, whence it was transported down the rivers.

12201. Then this trade, although a new trade as regards this country and Denmark, is not entirely a newly-created trade—the cattle were there before?—Yes, the cattle were there before; butter as a local manufacture existed for a long time before the railway.

12202. Are there considerable herds of cattle in this neighbourhood, and all along to the south of the railway line?—Some of the herds are enormous.

12203. Have they increased in numbers of late, owing to this butter trade?—The number of cows probably has not increased, but the improved way in which they are fed has increased the quantity of milk that is obtained from the cows. If we watch a given district in Siberia, we can see that every year the butter production grows by from 10 to 30 per cent.

12204. That, I presume, refers to the places you have specially named?—Yes.

12205. Not to places further east?—To places south of the line.

12206. Is there not some export trade in butter to the East?—It has just begun, since the railway was continued to the East.

12207. There will be a trade, therefore, away from Europe and towards China and Japan?—Yes.

12208. The cattle that are now there are indigenous cattle; have they been improved by breeds from other countries?—Some experiments have been made in crossing the cows in order to improve the breed.

12209. What becomes of the cows when they grow old; are they killed for meat?—They are killed and eaten in the district by the inhabitants.

12210. But the inhabitants, you tell me, are very few?—Yes, they are few, but they are enough to eat the meat.

12211. There has been an increase of inhabitants lately, and the number of cattle has increased proportionately; has it not?—Statistics over such an enormous stretch of country are, of course, very difficult to obtain, but I think that after the Siberian Railway was made, and when the butter production sprang up, the quantity of unused cows—that is, the ones that are not useful—diminished on the average, and only those which were good yielding cows were kept.

12212. You have confined most of your replies to the purely Siberian butter; do the remarks as regards the Reichert-Wollny numbers, and the general conditions of feeding that you have made in reply to questions apply equally to the Vologda and the Yaroslav butters in Russia proper?—They can be applied equally to European and Siberuian butters.

12213. I believe the summers in European Russia are, as a rule, not so warm as they are in Siberia?—Therefore the fluctuation in Siberia is greater than it is in European Russia.

12214. As regards the total export of butter from Russia to the West, can you give us any idea as to what proportion comes from European Russia and what proportion from the districts on the Siberian line?—I cannot tell you exactly, but, roughly speaking, from 15 to 20 per cent. of the butter is European butter, and the rest is Siberian.

12215. Then not more than one-fifth of what we receive here from Russia probably would be European, and four-fifths would be Siberian?—Yes.

12216. Do you anticipate that the Siberian export is likely to increase in the next few years considerably?—I anticipate that this export will continue to grow, owing to the measures that are being taken now by the Russian Government to secure that the cows shall be kept in warm places in the winter, and shall be better fed.

12217. The volume of the trade will be greater then in the future than it has been in the past?—Yes.

12218. Will that apply also to European Russia?—Not to such a great extent.

12219. The means of transit from Vologda and Yaroslav have, of course, been long established?—I do not think the trade will increase to such an extent in these places as it will elsewhere, because all the butter that is produced there goes to St. Petersburg, Moscow, and the adjoining towns.

12220. You mean it is wanted for consumption by the population in the neighbourhood?—Yes.

12221. As the towns grow in European Russia they will eat their own butter, but there is not a sufficient population in Siberia to eat all the butter that is produced there?—That is so. The internal consumption of butter is growing to a very large extent; that is why the Siberian butter goes into European Russia and helps the butter producers of the north of Russia. I may mention as an instance that the cheese produced in Russia, although it is a very large production, is, owing to the population being so great, all consumed in Russia. None of it is exported.

12222. Can you tell me, as a matter of practice, whether milk by itself is consumed largely over Russia as an article of diet?—The consumption of milk grows annually all over Russia, because, generally, the Russian people are very fond of milk, and they do not like butter.

12223. When I have been in Russia I have gathered the impression that milk is a very large item in the

M. Kalantar.

21 Jan. 1903.

ordinary Russian's diet—larger perhaps than in any other part of Europe?—Yes.

12224. Can you account at all, then, for the development of the export trade round practically two centres only of European Russia? It has not developed in the south or in the richer agricultural land to any great extent?—In South Russia and in all the other provinces but those where the butter production is rather great, the people find their interest leads them to grow grain.

12225. The districts are arable districts, and are not favourable to butter production?—It is not that, but the land is so rich that they do not want manure.

12226. You are speaking of the black earth region?—Yes. Now, when the black earth is not so rich as it used to be some years ago, they are commencing to use manure in the south. In the north parts they have had to use animal manure, and they keep a large number of animals in order to make the earth richer there. That, I think, is why the milk production and the butter production is to be found in the one part.

12227. You have given us the export of butter from Siberia, and the export of butter from Central and Northern Russia, but I do not remember, in the tables or in the evidence, that we have had any mention of the export of Finnish butter, which forms part of the butter which arrives here from Russia, and which comes through the Finnish ports of Helsingfors and Abo?—Finland has quite a separate sort of government; they have their own analysts, and I cannot give you any information about them.

12228. That is why you have not mentioned them in your evidence?—That is so.

12229. (*Professor Thomson.*) Are we to understand that you advocate a standard with regard to butter?—I personally think that it would be a good thing to have a standard, but in the interests of my country I think it is impossible, because, with all this fluctuation in the quality of butter, it would be impossible to apply a standard if you take the present state of chemical knowledge.

12230. If a standard were to be fixed, would you base it on a Reichert-Wollny number?—I think it would be impossible to have a standard based either on one method or another.

12231. You consider it impossible to fix an exact standard at the present moment?—Yes.

12232. Does that mean that if a standard were fixed you would prefer a standard varying with the period of the year?—That would be a very difficult thing also, because if winter butter was kept in refrigerators, and then brought out in the summer, how could the summer average be applied to it? It is really a very difficult question.

12233. (*Mr. Gibbons.*) Do you see any reason why a different standard should be applied to Russian butter from that which is applied to butters coming from Denmark or Finland, or any other country?—I think, on the whole, it would be impossible to have any standard whatever. I think the best thing would be to have an international conference on this question, because the Reichert-Wollny and these other special analyses are far from being perfect. This can be shown by an example. I can send you two samples of butter, one of which will be so hard that you cannot even bite it, and it will have a very high Reichert-Wollny figure, whereas the other will be a very soft butter, but will have a very nice taste and a very low Reichert-Wollny figure. Now the Reichert-Wollny is the most perfect of the known means of finding out the quality of butter, and that shows the imperfect state of our present knowledge.

12234. (*Professor Thomson.*) Those butters that you are now speaking of would, I presume, be true butters?—Yes.

12235. (*Chairman.*) Is there any relation between the market value of butter and the Reichert-Wollny figure?—There is no relation whatever between the price and th Reichert-Wollny figure. The Reichert-Wollny figure does not indicate its commercial value, because when you take a butter into the market buyers do not look at the quantity of volatile fatty acids, but they judge by its taste, its appearance, and all that. Then there is a proportion of olein and stearin, and different other things, in the butter.

12236. (*Mr. Gibbons.*) Why should one butter be hard and brittle and the other, made the same way, be so soft?—No answer can really be given to that question, but there is a theory that hard butter is obtained when the cows are feeding in an oak forest or are being fed on oak leaves. In the case of the soft butter I have in my mind I do not know where the cows are fed, but the iodine absorption and the Hubl figure were very high.

12237. (*Mr. Dunn.*) Are the cows in Siberia exposed to very much more cold than the cows in Western Europe?—It is much colder there than in European Russia.

12238. Do you attribute the low average of the Reichert-Wollny numbers to that fact?—Yes, to a certain extent.

12239. I think you have told us that they are improving the housing of the cattle very rapidly?—Yes. The principal reason why the butter is better in, say, Omsk, is because the stabling is better.

12240. By better, do you mean that the Reichert-Wollny standard is higher?—We cannot say that, because these analyses only extend over one year.

12241. But you say the butter is better?—Yes; stabling is one of the reasons, and another reason is better feeding. A third reason is that the butter is sent over in refrigerator cars.

12242. How has the improvement in housing been brought about? Has it been done by Government, or is it due to the fact that the people have found that it is to their own interest to make this improvement?—It has not been a Government matter. The people themselves are doing that because they see that under improved conditions they get more milk.

12243. They see that it pays them to do it?—Yes.

12244. Is the improvement very rapid?—It is much more rapid than in European Russia. The construction of the Siberian Railway has made the people very energetic in that district.

12245. There is room for improvement, I suppose, even yet?—Yes; and there is plenty of room for improvement in European Russia also.

12246. (*Chairman.*) Does the Government advance money for improving stabling?—There is a three years' credit given by the Government, and also Government instructors are sent to help the people to a certain etent—on credit, of course.

12247. What do you mean by a three years' credit? Is it a sum of money repayable in three years?—It is repayable in four years.

12248. (*Mr. Dunn.*) Are we safe in assuming that when the improvement in the housing of the cattle has become general, the Reichert-Wollny numbers of the Russian butter will be the same as the Reichert-Wollny numbers on an average of the Western European butters?—It is very probable.

12249. Are the breeds of cattle in Russia being improved rapidly?—The Russian cow itself is a very good cow, and so the principal things that are being done are better feeding and better stabling.

12250. Is the Russian cow a small cow like our Kerry cows in the South of Ireland—the quantity of milk made by it seems small?—It is a small cow.

12251. That would probably explain the small quantity?—Yes. Some of them, however, are a little larger than the cow that you mention.

12252. What variety of cheese is made in Russia?—There are different sorts of cheese made all over Russia. Our total production of cheese is about 250,000 cwt.

12253. All of which, I understand, is consumed in Russia?—Nearly all of it is consumed in Russia.

12254. Is the making of butter in Siberia very profitable?—Yes, it is.

12255. And it is likely to continue growing rapidly for a number of years, I suppose?—Yes.

TWENTY-FOURTH DAY.

Thursday, 22nd *January* 1903.

MEETING HELD AT 32, ABINGDON STREET, WESTMINSTER.

PRESENT:

The Right Hon. HORACE CURZON PLUNKETT, F.R.S. (*Chairman*).

Sir CHARLES A. CAMERON, C.B., M.D.
Professor T. E. THORPE, C.B., LL.D., F.R.S.
Major P. G. CRAIGIE, C.B.
Mr. ROBERT A. ANDERSON.
Mr. CHRISTOPHER DUNN, J.P.
Mr. GEORGE GIBBONS.
Mr. JOHN GILCHRIST.
Mr. PATRICK HICKEY.
Professor J. M. THOMSON, LL.D., F.R.S.

Mr. A. E BALLEINE, *Secretary*.

M. KALANTAR (who was accompanied by Mr. NICHOLAS SMIRNOFF as Interpreter), recalled; and further Examined.

M. Kalantar.

12256. (*Professor Thorpe.*) You promised yesterday to bring to the Committee some information concerning the Margarine Law of Russia; have you been good enough to do so?—Yes, I have here a copy of the Law.

12257. Would you kindly explain it to us?—The Law begins by saying that margarine must be always sold under the name of "margarine," so that the consumer can understand that it is the product obtained from fresh animal fats, from which stearin has been separated by M. Mourier's method. The manufacture of margarine is only allowed in premises which are specially built for the purpose. The slaughter-houses and the butchers, and the margarine factories, are under the control of the Government Inspectors, who are constantly on the watch to see that everything is properly done. These Government Inspectors are under the Ministry of Finance, and they receive their salary, etc., from it. It is strictly prohibited to make margarine of the same colour as butter.

12258. The colouring of margarine is prohibited in Russia then?—Yes. It is also strictly prohibited to mix margarine with other kinds of fats, and with butter, for the purpose of selling these mixtures as butter. Further, it is prohibited to keep these mixtures in shops which are avowedly kept for the sale of butter.

12259. Then a butter retailer may not likewise sell margarine?—That is what it means.

12260. (*Chairman.*) Can a retailer sell a margarine mixture if he does not sell butter?—Admixture is not allowed.

12261. As I understood from what you have just now read of the Law, it is allowed as long as the mixture is not sold as butter?—It is prohibited to make mixtures, and it is prohibited to sell mixtures; and it is prohibited to keep such products in shops used for the purpose of selling butter.

12262. (*Mr. Anderson.*) Does that last prohibition apply to margarine or to mixtures?—It applies to mixtures and to margarine as well.

12263. (*Chairman.*) May a man set up a shop to sell margarine mixtures and nothing else?—Only margarine can be sold—separately.

12264. (*Professor Thorpe.*) There is no question whatever about that. There are only two products known in Russia—butter and margarine, and margarine is not allowed to be mixed with any other fat or to be coloured; they sell it as margarine, pure and simple?—Yes. In Clause 2 of the Law it is said that it is not allowed to make mixtures.

12265. (*Chairman.*) For the purpose of selling them as butter?—That is not what it means. It means that it is not allowed to make such mixtures at all. The material that envelopes the parcel or package of margarine, and the box, must have it clearly stamped or printed outside that it is margarine and nothing else; also, if it is packed in a barrel, there must be outside in large letters "margarine." If a shop is selling margarine, it must have outside in large letters an announcement that it is selling margarine. In all shops where milk or other dairy products are sold, the sale of margarine is strictly prohibited. It is strictly prohibited also to bring any margarine products from abroad into Russia. The Ministry of Finance, with the Ministry of the Interior, has framed certain rules and regulations for the guidance of the Government Inspectors who look after this special subject. The punishment for infringing this Law is a fine not exceeding 100 roubles (£10), or imprisonment for a term not exceeding one month. The Law was promulgated on the 8th April, 1891.

12266. (*Professor Thorpe.*) Can you inform us whether or not you are satisfied with the efficacy of the Law? Have you sufficient knowledge of the working of it to be able to assure us that it is efficient?—As the butter production is increasing in Russia, that, of course, is a sign that in some respects this Law is efficient, but they are going to make an amendment of the Law to this effect: The addition of the 10 per cent. of cream which is allowed by the present Law is to be prohibited, and the fine and the punishment are to be made more severe. Then the society which is founded for fighting against all kinds of adulteration will have facilities given to it, especially as regards margarine adulteration, if such a thing should happen.

12267. You make reference to a society established for the purpose of preventing adulteration; is that a voluntary association, or is it a Government institution?—It is a private institution.

12268. Is it a society instituted by those interested in the sale of butter primarily?—It is instituted by persons interested in the sale of all food stuffs, not of butter alone. The Government, on its part, is founding these laboratories to investigate adulteration if it should take place.

12269. These laboratories are State-endowed institutions?—Yes.

12270. A few weeks ago there was a statement which circulated in the English Press, on the authority of such an important news agency as Reuter, to the effect that the Russian Government has instituted a prosecution for fraud against a man named Balitski, who is alleged to have been supplying some English firms with adulterated butter. Is that statement accurate?—He is not being prosecuted for sending out adulterated butter, but for defrauding the company in money matters. It can be officially proved that that is the case.

12271. I am only giving you what actually has appeared in the Press. Before I ask you some questions concerning the chemical characteristics of butter, which you have brought under our notice, I should like to examine you on one or two points of a general character. I suppose it is the fact that until these analytical returns were compiled by the laboratories

M. Kalantar.

22 Jan. 1903.

in Russia, practically very little or nothing was known about the composition of Russian butter?—We have been investigating the butter which was sent in by the Government Inspectors for the last ten years.

12272. The butter industry in Russia has, in a somewhat peculiar manner, come under the benevolent consideration and treatment of the Russian Government, has it not?—The Government has always helped this industry from its beginning, 30 years ago, when it sprung up, though at first it did not render so much assistance as it does now.

12273. The importation of butter from Russia and Siberia on any very considerable scale into this country is a matter of comparatively recent occurrence?—Yes.

12274. It is only within the last few years, in fact, that any very considerable trade in Russian butter with England has been carried on?—It has begun to spring up rapidly since 1897. Before that there was a certain amount, but the rapid strides began since 1897. Really this export commenced in 1894.

12275. Although the export began in 1894, it is only since 1897 that any very rapid increase has taken place?—Yes. There was an export even before 1894, but it only existed to a very small extent.

12276. Are you familiar with a recent report from our Consular Agent in Russia, which has been printed by our own Foreign Office?*—What is stated there is quite right. The first dairy factory opened in Siberia was opened in 1893; but the butter was exported from European Russia into England before that.

12277. Without committing yourself, as you obviously cannot at the moment, is it your impression that the statistics which appear on page 14 of that pamphlet showing the growth of the export of Russian butter from 1898 to 1902, the last year for which returns are available, are substantially correct?—Yes. That table, I take it, represents the export of Siberian butter into England.

12278. It comes to this then, that the importation or exportation from Siberia of butter has arisen from 5,416,800lbs. in 1898, to 90,280,000lbs. in 1902. There has been an extremely rapid increase, therefore, in the amount of exported butter?—Yes, but this is not all the butter that is exported, because a Russian table, which I have with me, shows that a certain amount of butter went to the Asiatic frontier as well. The last year for which I have the Russian statistics is for 1898, and the total quantity of Russian butter exported then is given in the Russian statistics as 616,000 pouds, but in your Consular report it is put down as only 150,000 pouds; so you see that a good deal more was sent away than appears in your return. Your figure is quite right with regard to the export to England, but the total production was larger.

12279. The report states that, and it shows, in fact, not only the amount that comes into the United Kingdom and Denmark, which are the principle centres of demand, but it shows that the Siberian product also goes east to Port Arthur, and to China and Japan?—This report is quite right. It refers to a special butter which is called export butter. The butter that is melted goes in large quantities to Turkey.

12280. In consequence of this enormous expansion of the trade due, I suppose, primarily to the construction of the Trans-Siberian Railway, Russia has now become the second in point of order of the countries from which we receive butter?—Yes.

12281. This butter is mainly produced on peasant farms and small estates in Siberia?—These farms I should state must not be understood in the same sense as the English farms, or the Danish farms. In this case a farm means a whole village, which has a good piece of land, and the inhabitants of which own from 1,000 head of cattle to about 10,000 head of cattle. All the milk is collected from all this herd and mixed together, and the butter is made from that.

12282. Is this statement on pages 12 and 13 of the Consular Report correct:—"One of the first direct results of the completion of the western section of the railway has been the extremely rapid progress made in the production and export of Siberian butter, chiefly owing to the continually-growing demand for this product in the United Kingdom. Numerous Danish and German, and in some cases British, offices engaged in this trade are already established in various Siberian transit centres"?—That is right.

12283. "Dating only from 1894, previous to which no butter at all was produced for export, and commencing in the neighbourhood of Kourgan, it has now spread to Omsk, Kainsk, Novo-Nikolaievsk, Barnoul, Biisk, and Minussinsk. It is now the main resource of the peasant population of these districts"?—Previously it was not the main resource; it was quite a secondary resource which the peasant population had; but now it is changing owing to the different measures that are being taken.

12284. It is still the fact that the peasants are the chief suppliers of the milk which furnishes the butter?—Yes; there are some private people who have their own estates, and who supply milk, but the bulk of the milk is obtained from the peasantry.

12285. Is this also correct:—"The establishment of peasant associations and societies supplying the various export offices has taken from the industry something of its original piecemeal and primitive character, while the superior enterprise and modern improvements of the export firms, foreign and Russian, which have settled in the country itself, could not but greatly better the conditions of production"?—The condition of things before and after 1894 are really altogether different. Before 1894 there was not a single separator in Siberia, and now there are several thousands.

12286. In fact, it is only since 1894 that the whole industry has been organised upon modern commercial principles?—Yes.

12287. You told us yesterday what steps the Government had taken to foster the industry, by the installation of laboratories and the appointment of dairy instructors, but even at present I suppose Russian butter does not command quite the same market value as Danish butter?—Quite so; and the reason is the long transit. That is shown by the winter butter, as sold here, being better than the summer butter; it is priced higher here, though it is in a worse condition chemically. In respect to taste, our winter butter is worse than the summer butter, but it comes over in a much better condition than the summer butter, and therefore that is better priced. The butter that is received from Kourgan reaches from 100s. to 106s., whereas the summer butter is sometimes even below 80s.

12288. That is not quite what I want to know. Supposing I, as a merchant, bought butter; could I get butter cheaper in Siberia than I could get it in Denmark? I am putting aside the cost of transit; I only want to know the price of butter on the spot?—Yes, it would be cheaper.

12289. Considerably cheaper?—I cannot answer that question exactly, because I do not know the Danish prices, but I think it would probably be so. Milk in Siberia is much cheaper than it is in Denmark, and freight is expensive.

12290. For the moment I am putting freight aside, and I am only dealing with the intrinsic quality of the butter. I suppose I may take it that, considering the comparatively new character of the industry—for it has practically only been organised you say since 1894 or 1895—there are still many primitive methods of farming on the part of the peasants which have to be grappled with?—The peasants themselves do not make the butter; they only supply the milk. It is only the associations and special dairies that make the butter.

12291-2. I presume one reason why the Danish product has got its pre-eminence is on account of its uniformity of character?—From a market point of view that would be so, and the reason is the long transit, the storage, etc. If you examine the Danish and the Russian butters chemically you will not find very much difference between them, the difference is only from the market point of view, and from that point of view it is quite true that there is an uniformity in Danish butter.

12293. Of course, to the degree that Danish butters vary, we have already got very full information, and we know within what limit they vary; but do you not know, for example, that considerable pressure has been brought to bear on Danish farmers to adopt a system of calving all the year round?—I do not know the Danish position so well as I know the Russian position, because I am a Russian expert only; but at the same time I

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* "Trade of Siberia," Consular Report (Miscellaneous Series), No. 585 [Cd. 787/21].

M. Kalantar.

22 Jan. 1903

do not think that the calving all the year round would be one of the principal reasons for the uniformity of the butter. I should rather attribute that uniformity to better feeding and to keeping the cows in an even temperature all the year round; those would be the principal causes of the uniformity of Danish butter.

12294. No doubt those are contributory causes, but be that as it may, perhaps you will take it from me, if you do not exactly know—because we have had it in evidence—that in Denmark one of the points which characterises the production of butter is the insistence, so far as it can be brought about, on this principle of calving all the year round?—I agree with you entirely on that point.

12295. I am sure you will also agree with me on this point—that the effect of that is that there is a regular proportion of cows in what English farmers call full profit and of cows which are stale—a due proportion all through—and that that tends to an equality or uniformity in the composition of the butter?—I agree with you on that point, too; but at the same time I do not think that that is one of the principal factors; it is one of the factors, but not one of the principal factors that has helped to obtain this uniformity in the butter.

12296. You would add to that factor what you have already mentioned, I presume, namely, improved fodder and comparatively warm housing?—Yes; and not only those, but all these causes working together.

12297. No doubt they all operate in the same direction?—Yes, they do.

12298. You tell us in your synopsis that in Siberia the cows are made to calve very much at the same period of the year throughout the whole district?—Yes; generally speaking, the calving begins in January and continues through February and March and part of April. Of course, I do not mean that calving may not take place a little before or after that period.

12299. But the practice is to confine it to that period?—Yes.

12300. In other words, the cows are made to calve during the winter months?—And the spring months.

12301. Your spring is a very late spring, I suppose?—By the end of April it is quite spring there, because farm labour begins then.

12302. Have the great bulk of the cows then been turned out to pasture?—Generally towards the 20th April the cows are sent out to pasture. I wish to draw your attention particularly to the fact that Siberia is an enormous country. In the Altai provinces the spring is much earlier, and as they are really in a very southern part of the world, it is very warm there, with very early springs and late autumns. If you take Kainsk, that is more northern. Therefore the climate in Siberia is not a uniform one.

12303. That, of course, we understand; the point remains that the greater bulk of the calves are born within three months of the year?—It is impossible to state that positively. Owing to the vastness of the country no exact statistics can be given on that point.

12304. I only take what is placed before me in this Consular Report?—And that is true as a general picture.

12305. Is any pressure being brought to bear upon the farmers to adopt the system which has been proved to be successful in Denmark, namely, of calving or trying to calve all the year round?—As I said yesterday, the dairy instructors, the *agronomes*, that are working there, and the local societies are all trying to improve the condition of the cows in all respects.

12306. Including that respect?—Yes.

12307. You have admitted, therefore, that if the period of lactation were better spread over the year—so to say, throughout the year—the effect would be a greater uniformity in the character of the butter?—I want to repeat again that I think the calving is not the principal cause, although it is one of the causes.

12308. I am quite aware of that; but nevertheless you will admit that the effect of a more equable distribution of the calving period would be to tend to make the butter of a more average composition, and thus would narrow the extreme variations that there are, we will say, in the amount of volatile acids?—Certainly, but in a very small degree. I say again I do not think that is the chief cause.

12309. At the present time you tell us that of the so-called winter butter of Russia, there is only 4 per cent. which gives a Reichert-Wollny number below 23?—Yes.

12310. Can you inform us whether there are any serious economic difficulties which would prevent the peasant from, in the first place, attempting to put into practice this principle of calving throughout the year; and, secondly, whether there are any very serious difficulties in making him improve the conditions under which his beasts are kept?—The warm stabling and these other improvements that we have been speaking of are being adopted by the peasants. They can be introduced with more facility than the proposed change in the calving, because the peasants are very conservative in these matters, and they keep to the old ways. A change in the period of calving would be the most difficult thing to do in comparison with the other changes.

12311. I should imagine that it is much more difficult to impress upon them the desirability of their cows calving throughout the year than to impress all the other matters upon them; but I have no doubt you will take it from me that that difficulty is met with everywhere among a peasant proprietary?—Yes.

12312. It is one of the difficulties that they are still contending with in Holland and Friesland, but it has been very largely overcome in Denmark, as you are probably aware?—Yes.

12313. Do you foresee that there will be any insuperable difficulty in its being overcome in European Russia and Siberia by the pressure which can be brought to bear upon the peasants through the societies with which they have to deal?—That is a difficult question to answer. I cannot look into the future; but I think, judging by the energy displayed by the Siberian peasants, that they will eventually be overcome. How long the present methods will continue I cannot tell.

12314. Nevertheless, would you say that it is something that we can look forward to as coming?—I cannot say, but it is very probable. If you compare the condition of the peasants before the Siberian railway was built, with their present condition, you will be surprised at the amount of energy with which they have adopted new methods.

12315. I suppose we may assume that if this country, which is now one of the chief markets for Russian butter, were in the interests of purity of butter to impose a Reichert-Wollny limit, such as has been suggested, on which to raise a presumption as to the genuineness of butter, the movement in favour of the equable calving of the cows would probably be greatly accelerated?—I think the Reichert-Wollny figure has no influence upon the population at all. I think that a lot of different measures and different factors have helped to produce this energy on the part of the local population. The Reichert-Wollny figure is no criterion of the market quality of the butter or of its taste.

12316. I will deal with that afterwards; the connection between the market value of butter and its Reichert-Wollny number is quite another matter. I gather that you have some idea in your mind of the gradual amelioration, if I may so call it, in the character of butter as regards the amount of volatile acids it contains; otherwise I do not understand the significance of your recommendation that as the question is "a very important and an international one, it is only just for a more satisfactory solution to (*a*) postpone for some time the definite fixing of the standard, and meanwhile to (*b*) convene an international conference of chemists and physiologists to mutually consider the question, and to try to find out the best means for its solution"?—I know of many instances where the feeding, the stabling, and the calving—all these combined conditions—could not be under more favourable circumstances, and yet the Reichert-Wollny figure has been below 23. You can see that from the tables I have handed in. (*Appendix XXXII.*) Take, for instance, Table VII. The figures there are of cows which were kept under these ideal conditions as to feeding, warm stabling, and calving nearly throughout the year. The calving took place from September to the end of spring; there was no calving in the summer. The estates dealt with in Table VII. are private estates.

12317. But even there, under those circumstances, the butter might be a product compounded partly of the milk of stale cows?—Yes.

12318. That is my point. That only emphasises the importance of calving all the year round, because you admit that the feeding, the stabling, and all the other conditions of comfort for the cow were already achieved, and therefore the factor which was not achieved was the

M. Kalantar.

22 Jan. 1903.

calving?—The greatest number of dry cows occurs during the summer; indeed, all the cows there are dry during the summer.

12319. I do not understand the significance of your recommendation. You evidently contemplate the definite fixing of a standard, but you ask that it should be postponed for some time. I gather that that is in order that the Siberian and Russian producer may have time to overtake the same character of conditions which has been imposed upon the Danish producer, and so bring up his product to that character of uniformity?—I do not think any of the methods by which up to now butter has been analysed can prove anything, even if a certain interval were to elapse before the standard came into force, and even if the butter were better made. I think that the chief point to be aimed at must be an international meeting of chemists, physiologists, and specialists on this question, so that new methods of analysing butter could be found. That is my point.

12320. You are sanguine apparently that if half a dozen, or many dozens if you like, chemical experts and physiologists were to meet togther, they would be likely to devise some chemical method of detecting the sophistication of butter?—I want, if possible, to have an international meeting of chemists and physiologists who would decide how to gather from the existing systems of ascertaining whether a butter is adulterated or not, a new method by which it would be more easy to detect whether the butter was genuine or adulterated. Up to now the Reichert-Wollny has been the principal means by which the butter has been checked.

12321. You will excuse me if I take exception to that statement. We are only arguing now as to the Reichert-Wollny number, because we must have regard to the terms of reference which have been given to us; but chemists to-day take not only the Reichert-Wollny number, they take all the analytical factors into consideration in judging of a supposition or an inference?—That is done in Russia also. There the butter is analysed in different ways. A standard ought not to be founded on a Reichert-Wollny figure only.

12322. That is perhaps a matter for argument. What we as a Committee are concerned with trying to find out is by what methods, chemical or other, we can devise a process on which the presumption shall be raised that a sample of butter is not genuine?—I was under the impression that this Committee was required to report on the separate chemical ingredients of butter, just in the same way as was decided about the water in butter.

12323. We are "to inquire and report as to what regulations, if any, may with advantage be made under Section 4 of the Sale of Food and Drugs Act, 1899, for determining what deficiency in any of the normal constituents of butter, or what addition of extraneous matter, or proportion of water in any sample of butter shall, for the purpose of the Sale of Food and Drugs Acts, raise a presumption, until the contrary is proved that the butter is not genuine"?—I have read that, and that is why I still adhere to my point, that an international meeting of specialists must be held in order to decide this question by selecting methods of analysis out of the existing ones, or, if possible, devise a new method of analysis. The methods which have been in use up to now cannot show us the exact dividing line between the genuine and the adulterated product.

12324. May I again ask your attention to the wording of our reference. I presume you will admit that the butyric, the caproic, and the caprylic acids are normal constituents of butter?—Yes.

12325. And that those are the constituents of butter which affect the Reichert-Wollny number?—Yes.

12326. It is surely within our competence to determine, if we think fit, what deficiency in these things shall raise a presumption that the butter is not genuine?—It would be so, if we knew beforehand the maximum and minimum limits of the Reichert-Wollny figure in natural butter; but we do not know it.

12327. I do not quite understand the relevancy of that answer: Do we not know sufficiently near from the very tables you have given us, the range in the variation of the Reichert-Wollny number, that is to say, in the proportion of the volatile acids?—You can see by the tables that the fluctuation is very great; therefore, from the Russian point of view, it would not be desirable to have a very low Reichert-Wollny figure or a very high one.

12328. That is equally true of every other butter-producing country?—No doubt.

12329. Of course, we have to look at this question as practical men in order to know what to do with a problem of this kind?—That is my point also, but at the same time I think it would be desirable that a genuine article should be looked upon as a genuine article. That is very important for the Russian producer, as well as for the British consumer.

12330. Our problem in the case of butter is very similar to what we had to grapple with a short time ago in the case of milk. In the case of milk, we fixed as one criterion of its genuineness, the amount of butter fat which it contained. It was brought to our knowledge in the course of the inquiry, that now and again a cow was known to give perfectly genuine milk with a very low proportion of butter fat. If we had looked upon the milk from exactly the same point of view that you invite us to look upon the butter, namely, in order to devise means to comprehend, so to say, within our recommendation milks, no matter how poor in fat, although genuine, we should have had to put the limit of fat down very low indeed?—There is an enormous difference between the butter question and the milk question. In milk the low amount of fat proves the poorness of the milk, whereas a low Reichert-Wollny figure in butter does not prove that the butter is not genuine or of good quality, or that it is not nutritious.

12331. I admit the analogy is not perfect between the two things. I am only concerned now with the application of a principle of selection?—The principle is not quite right, and that is why I am against it.

12332. That must be a matter of opinion, I am afraid?—Quite so; that is what I say.

12333. My point is, that just as in the case of milk we had in the interests of purity to draw a line somewhere, so must we draw a line here in the case of butter?—I agree with you entirely as regards the milk, but as regards butter, how to do it is where the difficulty comes in.

12334. That is exactly what we are trying to come to some agreement about. In the case of milk we maintain that, although the imposition of a standard, say, of 3 per cent. of fat would now and again inflict hardship upon the farmer, because he might be condemned for what was the perfectly genuine product of the cow, nevertheless, in the general interests of the community it was perhaps better that one farmer should suffer than the whole of the community should suffer?—As regards milk that was quite right. A milk standard would affect separate individuals, but a butter standard might affect our whole nation, and it would not bring so very much good to yours; that is my opinion.

12335. In the case of milk we came to the conclusion that we might safely inflict individual hardship on the farmer, because we were informed that the farmer himself in a large measure had the remedy in his own hands, if he would but apply it?—I do not think it is just to view the matter in that way. There are about a million casks of butter made every year; if each cask could be analysed, and the identical person who did not treat his cows properly could be found out, then it would be a different thing; but that cannot be done, and I think your suggestion would be as unjust as it would be injurious to the whole Siberian butter industry.

12336. If I might be allowed to pursue the analogy of the milk a little further, my contention is that just as a farmer, when he had lost his trade by virtue of his own negligence, or by his want of conformity to the best methods available, had no market for his milk, so we think—at least, I think—that by the application of these suggestions, which have been thrown out to bring about uniformity of butter, your Siberian peasant farmer will eventually suffer no hardship. Just as in the case of the milk, we were obliged in the interests of purity, and in the general interests of the community, in the meantime to punish the farmer in order to bring him into line, so I think we are equally entitled to consider whether we should not bring that same amount of pressure to bear upon the Siberian farmer in regard to his butter?—But you admit that the analogy between butter and milk is not a very exact one?

12337. To this extent: that the criterion of quality in the milk is the fat, whereas the criterion of value in the butter is not necessarily the volatile acids?—We are continuing the argument on a wrong basis. The foundation for your statistics is not right, because the Reichert-Wollny figure is taken as the chief foundation, whereas the market quality of the butter and the Reichert-

M. Kalantar.

22 Jan. 1903.

Wollny figure are two different things altogether. If the foundation of your argument is wrong, then you must come to wrong conclusions.

12338. Now we will perhaps grapple with this question of the relation between the market value of butter and its character. I suppose we may take it for granted that price on the whole is a criterion of quality?—Yes, in general.

12339. The price also is in obedience to the law of supply and demand?—Yes.

12340. And there may be occasions when the law of supply and demand might artificially increase the price of an intrinsically inferior article?—In what way inferior?

12341. A butter which at one time would have a low price on account of the fact that it was inferior to a large number of butters already in the market, might at another time have a high price on account of the absence of those butters?—Yes, that would be so.

12342. As a scientific man I ask you, how can you think that there is any quantitative relation between the market value of butter and its essential character?—Do you mean that the price depends merely on its quality?

12343. I say it is in a measure independent of its quality. You have admitted that the price you can get for a butter depends very largely on the opportunity you have of selling it, and that, in the absence of other good butters which compete with it, you can get a good price for a relatively bad butter; therefore, I say there is no necessary, and invariable, connection between the price of butter and its quality?—I agree; but this happens at different times—today for a high quality of butter you may get a high price, but on another day it may be the reverse.

12344. That would be in accordance with the law of supply and demand?—Yes.

12345. That being the factor which determines the whole thing, what is the use of correlating the Reichert-Wollny numbers with prices?—You have not exactly understood what I wanted to state. Why is the winter butter so good, why is it sold at such prices, and why is its taste so good? All these things that we have available—those methods of analysis which exist at the present day—are not sufficient or efficient to enable us to speak about this parallel between the Reichert-Wollny figure and the market price of butter. It is to prove this point that I have sent in this table. To judge by this table alone we can come to quite opposite conclusions.

12346. There is not a single instance in this table of a low Reichert-Wollny number?—They are average figures, and the low figures necessarily come into them.

12347. (*Major Craigie.*) From the summer ones?—No, from the winter ones. I think that the Reichert-Wollny figure and the value, the price and the taste, have quite different relations between each other—they are not on the same foundation.

12348. (*Professor Thorpe.*) I venture to say that this table might be made to prove anything, having regard to the way in which the numbers are split up. I think, if I were to take all the high numbers and all the low numbers apart from a certain mean value, I should be able to prove that there was a connection between the price and the Reichert-Wollny numbers, and that in proportion as the Reichert-Wollny number went up so did the price. I also think that if I made another selection of numbers, I should be able to prove the opposite?—I agree with you that this table does not prove anything. That is why I have brought it, so as to show that there is no relation between the price and the Reichert-Wollny numbers.

12349. That is what we should all be prepared to admit?—At the same time I have evidence proving that the Reichert-Wollny figure does not prove that the taste is good and the price is high.

12350. I am afraid that we must put the price aside?—Not the price, then—the quality. I thought I could not bring forward evidence here that was not obtained from the Government Laboratory, but if other evidence is available, I can obtain it.

12351. (*Chairman.*) Is it not the fact that in the months when, owing to various causes, such as the cessation of the period of lactation, cold weather, and other causes, you have low Reichert-Wollny numbers in Siberian butter, the general prices in the English markets are at their highest?—Yes.

12352. (*Professor Thorpe.*) Riga, where the greater portion of your butter comes from, is a port which is closed during some portion of the year, is it not?—(*Mr. Smirnoff.*) M. Kalantar cannot give you evidence upon that point, but I can, as I am secretary of the Financial Agency. I can tell you that this year, with the help of ice-breaking steamers, they are going to keep up a communication between England and Russia, not, perhaps, throughout the year, but for three months more than they have hitherto, and perhaps it may be continued throughout the year. Up to now it has been a frozen port.

12353. What would be the natural effect of closing up the port? I suppose the butter would have to be held back, would it not?—It would then go viâ Libau. That is not a freezing port; it is always open.

12354. Does not the fact of communication with Riga being interrupted mean rather that there is a congestion of butter stocks?—That might happen. Where do you suggest that the trains would be stopped?

12355. Would there not be an accumulation of butter somewhere or another in the country?—On the railway, or in Riga itself?

12356. It does not very much matter for my purpose; butter is being made, and you cannot get it out of the country?—That would be all right. It would go straight viâ Libau, and would not be stopped. That is what has happened before, and it would happen now.

12357. In a rigorous winter?—Yes; if the ice-breaker could not keep up the communication, the bulk of the butter would go viâ Libau.

12358. This butter is now, under normal circumstances, I think, shipped in two ways from Riga—some of it goes to Copenhagen, where it is transhipped for the English market, and some of it comes direct to us?—The butter that goes from Riga goes direct to England; that which goes from Reval has hitherto gone to Copenhagen, but this year direct communication has been opened between Reval and England.

12359. A good deal of your produce in Russia and Siberia is in the hands of German and Danish merchants, is it not?—It is in the hands of British and Danish merchants, but there are very few German merchants there.

12360. Which preponderates, the Danish or the British?—The Danish; but the number of British firms has been growing in the last three years, owing to the direct communication between Riga and England.

12361. Is the number of English firms growing at the expense of the Danish, or is it due simply to the increasing growth of the trade?—There has been a great demand from English dealers in butter wishing to come into direct communication with the Russian producers of butter. I can prove that by the enormous amount of letters which are received at the Financial Agency. M. Kalantar also knows that.

12362. I am obliged for the information, but it is not quite an answer to my question. You say the trade is practically in the hands of Danish and English merchants, and that the number of English merchants is gradually growing?—Yes.

12363. Is the number of Danish merchants, *per contra*, diminishing?—To a certain extent, as a matter of proportion that is correct. The growth of the Danish firms is not so rapid as it used to be, and it is not so rapid as the growth of the English firms; but, all the same, the production of butter is increasing to such an extent that there is sufficient trade for both. In the last few years the number of Danish firms has not increased as has the number of English firms.

12364. Do you know what precautions are taken to avoid mixing up the Russian produce with the Danish produce and its being transhipped from Denmark and sold as Danish butter?—(*M. Kalantar.*) I cannot give you that information, as I have not the facts before me which would enable me to speak definitely. Roughly speaking, I know that the Danish people sell Russian butter in Great Britain, not under the name of Danish but under the name of Russian butter.

12365. There can be no harm in that, but I want to get it quite clear. The point is whether we in England,

M. Kalantar.

22 Jan. 1903.

in purchasing what is called Danish butter, sometimes get Russian butter?—I cannot answer that question.

12366. Obviously there might be a strong temptation on the part of Danish agents in Siberia to take advantage of the high price which Danish produce gets by substituting Siberian produce for Danish, or even by mixing the two; but you say you are not able to give us any information on that point?—No, I am not.

12367. Would you be so good as to turn to the tables of analyses which you have prepared for us? With which laboratory are you yourself mainly concerned?—I do not work now in any laboratory, but I used to do so. (*Appendix XXXII.*)

12368. Why I asked the question was because I notice that in Table I (A) and (B) you have given us two series of analyses which are not exactly comparable—I mean that those which were made in the St. Petersburg City Laboratory are much fuller than those which were made in the Bacteriological Laboratory of the Ministry of Agriculture. In the analyses which were made in the St. Petersburg City Laboratory all the criteria which we are in the habit of applying to butter were tested. What is the reason for the difference?—At one time all these analyses were made at the Bacteriological Laboratory of the Ministry of Agriculture, but that laboratory was found to be comparatively too small for the work, and there were not enough analysts on the staff. Therefore, for a certain sum of money all this work was put into the hands of the St. Petersburg City Laboratory, and the fuller tables were given. The analyses which were done at the Bacteriological Laboratory were done whilst I was away on Government business, and that is the reason why the tables are not so full as the later ones. Upon my return I gave instructions for full tables to be prepared, and they were made accordingly at the St. Petersburg City Laboratory.

12369. Of course, as a chemist you will admit that they are much more valuable, as giving a true clue to the composition of the butter?—Yes, of course. You can see that those made at the City Laboratory are fuller, but the analyses were just as accurately made in both cases.

12370. The special numbers, no doubt, are equally accurate, but the second series are fuller?—Yes; and these later analyses are being continued.

12371. In Table B, which is the full table, samples of butter collected at various times of the year—December, January, February, March, April, and, in one or two cases May, that is to say, winter butters—have been analysed?—Yes.

12372. Apparently, roughly speaking, 74 butters have been analysed?—More. If you look at Table III. you will see that there were 40 in November, 29 in December, and 40 in January, without taking in the other months.

12373. Is Table III. an analysis or summary of Table B?—Yes.

12374. Take Table B as it stands for the moment, and run your eye down the Reichert-Wollny numbers; you will see that Nos. 314 and 315 are below 23?—Yes; those come from a private estate within the Moguilev Government. I have here a much fuller table, which has been prepared since. (Supplementary Table I.)

12375. Does it contain an additional number of analyses?—Yes; and it is more systematically arranged than the first table. The Governments are arranged separately, and the specimens are put chronologically.

12376. Does the running number correspond in the two tables?—No.

12377. Do the running numbers show the actual number of analyses that have been made?—Yes.

12378. Then your original Table B gives the result of 74 analyses?—It is more clear in Supplementary Table I. The first table (Table I.) is the one that was prepared by the Russian Government when in was thought that the Committee would be convened in June, and the Supplementary Table has been prepared in order to include later analyses. The foundation of the two is the same, of course, but the later table is fuller, and is arranged in a more systematic order.

12379. What is the table that you now desire to hand in, and upon which you desire the character of Siberian and Russian butter to be judged?—It would be much easier and better to go by the new one that has just been brought over; the foundation of both is the same, but the first one is not so full.

12380. I am at a disadvantage in that I have not had the opportunity of examining the second table*, but I have carefully read what has already been printed?—To a certain extent it is the same thing. If it would be more convenient for you to go by Table I., I am quite willing to answer.

12381. If you do not mind being examined upon the original Table I. (B), I think it will bring out the information I want you to give me?—It is just the same.

12382. We are dealing now with the analyses made at the St. Petersburg City Laboratory. It appears that of all the analyses which have been made in this table, only three show a Reichert-Wollny number below 24?—Yes.

12383. And, in addition, there are eight which show a Reichert-Wollny number below 25?—Yes.

12384. The inference I draw from that on these numbers is that a limit such as has been suggested of 24 Reichert-Wollny would not operate harshly upon such butters as are made during the winter months in these particular provinces?—You must take into consideration the other tables.

12385. I am coming to the other tables in a very short time?—Table B is founded on analyses made, not throughout the year, but at certain periods; but the Supplementary Table is fuller, and the analyses range from November, 1901, to August, 1902.

12386. We will come to that; but I am now dealing with the winter butter produced from certain provinces which have been analysed in the St. Petersburg City Laboratory?—The winter butter begins in September.

12387. I am only dealing with the numbers which are given to me here, and Table I. (B) deals with the winter butter, though it is true, not with all the winter butter?—The winter begins in September. You can divide the butter by the months, but not by the laboratories.

12388. I will come to the laboratories in a moment. All I am concerned with is the full analyses which have been put in from the St. Petersburg City Laboratory?—Another thing I wish to point out is that the Siberian butters take a certain time to get to the St. Petersburg Laboratory, while butter coming to the St. Petersburg Laboratory from Vologda would take less time, and therefore it would be in a different condition when it arrived.

12389. That has nothing to do with the point I am concerned with. I am not concerned with the date at which the analysis was made, but with the date at which the butter was made, and that, according to the head-line, is given in your fourth column. If it did change on the journey, it would be in the direction of lowering the Reichert-Wollny number?—Yes.

12390. So that if it took a long time to come, that would rather tend to lower the Reichert-Wollny number than to increase it?—Yes.

12391. We have done for the moment with the analyses made at the St. Petersburg City Laboratory. They show that, on the whole, the butter made in these particular provinces and analysed in that laboratory has a relatively high Reichert-Wollny number; that is the general complexion of these analyses, is it not?—I do not quite understand. Do you mean that in this table (A) of the analyses made at the St. Petersburg City Laboratory, the Reichert-Wollny figure relatively is higher than in the other table (B)?

12392. That it is normally good?—In comparison with the figures in the other table?

12393. No; in comparison with the butters we are getting from anywhere?—Yes, that is so.

12394. Now let us turn to Table A, which gives us the results of analyses which have been made in the Bacteriological Laboratory. We will confine ourselves for the moment to the Reichert-Wollny number, because that is almost the only point that is common to the two tables, so far as the analytical criteria go?—There are some other ones, such as water, and so on.

12395. Yes, but the water, the salt, and the fat are not wanted as criteria of the genuineness of the butter. Are not a certain number of the butters common to the two tables—I do not mean that they are repetition samples, but that they are collected from the same area?—That is so.

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* The Committee subsequently decided to print this "Supplementary Table I."

12396. (*Major Craigie.*) The contributory area of Table B and the contributory area of Table A is in some instances the same?—Yes, but the samples are different.

12396*. (*Professor Thorpe.*) They have been gathered from the same districts?—Yes.

12397. Have you any explanation to offer why the general complexion, if I may so call it, of Table A is so different from that of Table B?—If you look at the table which I have brought with me to-day, Supplementary Table I. you will see that that depends on the months.

12398. That is not quite my point. Whereas, in Table B, there are only three of the winter samples below a Reichert-Wollny number of 24, in Table A there are of winter samples coming from the same or similar districts a considerable number more?—There are 42. Table A is confined to November, December, January, and a part of February, whereas in Table B the months following are included when the cows start calving.

12399. In other words, it means this—that the same causes which have been shown to contribute in the case of Dutch cows which have been not stalled sufficiently early, and which have been kept in the meadows during the cold and autumnal months, have been found operative here, as in Friesland and other places?—Yes.

12400. I gather that these tables are not your analyses, and that the two sets of analyses have been made by different operators?—They have been made by quite different chemists.

12401. Have the numerical results in these tables been analytically examined by you in order to determine how far the personal factor of the operator affects the Reichert-Wollny numbers?—I have noticed the difference which appears in the results from the two laboratories, but I again say that that is due to the different months being taken. I wish to draw your attention to this—that the analyses were made in the manner described in Benedict's book. Both sets of analyses are done in exactly the same way in each laboratory.

12402. In Table III., which is a summary of the samples in Table II., the results are grouped together partly in years, and partly in months. Now, look at the month of October, 1901; only one sample is dealt with there, and the percentage is given as 100. Of course, I know that that is not intentionally done, but it might go out from that table that 100 per cent. of all the samples in that month were below the Reichert-Wollny number?—That is only a way of showing the percentage—that is all.

12403. Only one sample was analysed in that month, and the actual Reichert-Wollny figure, I find by inference, was 23·5. That is the exact number, and it comes out in a subsequent table?—I do not quite understand what you mean.

12404. I point out to you that it would be a fallacious statement, or a possibly fallacious statement, to say that 100 per cent. of all the samples in October give a Reichert-Wollny number below 23 or below 24?—That is only a way of writing it down.

12405. I am aware, but what does it mean?—If you will remember, not a word is said of this month in my synopsis. Either it ought to have been omitted altogether, or put down as it is put down. It is only a manner of writing.

12406. What does it mean? In plain English it means that when 100 samples of butter are analysed, they all fall below 24; but, of course, you do not intend that?—Only one sample was analysed; it was below 24, and therefore it is rightly put as 100, but it does not play any part in the conclusion which I have formed.

12407. This row of figures which purport to give the "percentage below 25," indicates the condition of the butters by reducing them all to one common set of terms; and if anybody were desirous of ascertaining the probability of the butter being above or below any given number in a given month, they would naturally take that series of figures?—Every month is brought out separately, and when the average annual figure is taken they are all added together and divided by all their respective numbers.

12408. We need not spend time about this, but this column for October is obviously apt to create a false impression?—Then take it out entirely, because the new analysis from last October can be put in place of it.

M. Kalantar

22 Jan. 1903.

12409. Very well; of course, it is a very unsafe inference to draw upon a very small basis?—I must repeat to you that it is only a way of writing it down; you need not draw any inference from it at all. As my explanation will be printed, it is quite clear now, and the best thing will be to take the column out entirely. It does not change the conclusions in any way.

12410. Go to the other extreme—namely, the month of August; there are only nine samples analysed. One only of those was apparently below 24, three were above 24, and the rest were above 25; and there, you say, 44·4 per cent. were below the Reichert-Wollny number 25?—Yes.

12411. We are quite at one about these figures, but I thought it my duty to point out that it is a very narrow set of premises on which to bring a very sweeping deduction?—In a year's time I can bring heaps of samples.

12412. Now we go on to Table IV. That table gives the monthly average and the Reichert-Wollny numbers of the butter from different Russian Governments. It is another form of summarising the results which are contained in Table II., is it not?—Yes.

12413. We will from this table, if you please—and I have no doubt you will agree with me—exclude the 23·5, which is the single analysis made in October on which you base that deduction of 100 per cent.?—Certainly.

12414. Now, it remains that on your average, although the extreme variations are given, the Reichert-Wollny numbers are well above 24—they are, in fact, all above 25?—The monthly average does not give a real conception of the composition of the butter; it only gives a comparison between the months.

12415. It gives the average character of the butter?—But not of the separate samples.

12416. That is, the value of the last column is considerably affected by the number of instances which may occur of minimal quantity?—Yes.

12417. It may happen, for example, that in a large number of analyses there may be only one, we will say, of 21·2 or 21·9?—If you will look at Table III., you can see how often the minimum is repeated.

12418. Let us now turn to Table VIII. Now we come to the Siberian butter. There we have a series of analyses of Siberian butter, showing their Reichert-Wollny numbers from December, 1901, to July, 1902; the butter being obtained from the Tomsk Government and the Omsk Government?—That is so.

12419. Will you look down that table and point out how many samples fall below 24? I think they are summarised in Table VIII. (c) at the bottom of the page?—Yes.

12420. And according to Table VIII. (c), two out of 77 fall below 24?—Yes.

12421. In other words, 75 out of the 77 analysed would not be affected by a Reichert-Wollny number of 24?—If those two were to be looked upon as adulterated, that would have a very bad effect upon all the other ones.

12422. But there are two out of 77 which would be hit by a Reichert-Wollny number of 24?—Yes, but condemning those would affect the whole *renommée* of the butter.

12423. (*Major Craigie.*) I think the answer to the question Professor Thorpe has put is, that only two out of the 77 samples in that particular table did, as a matter of fact, fall below 24; it is a matter of fact, not of opinion, that he is putting to you?—Yes.

12424. In other words, the table is correct?—Yes.

12425. (*Professor Thorpe.*) Now, turn to Table IX. This deals with Siberian butter from districts in the Tobolsk Government. The time over which it extends is from November, 1901, to August, 1902, which is a somewhat longer period than we had in the preceding table, which extended from December, 1901, to July, 1902. Going at once to the Table IX. (C), which is a summary in the same way from the details which are contained in Table IX. (A and B), we find that out of 77 samples which have been analysed, two are below 24, so that there again 75 out of 77 would not be affected by a Reichert-Wollny number of 24?—I agree entirely with

M. Kalantar.

22 Jan. 1903.

the figures here, but I do not agree with the conclusion that is drawn from them.

12426. That is a matter of opinion?—Quite so.

12427. It has been shown to us by Dr. van der Zande and Dr. van Rijn that Dutch butter would be affected to the extent of 3 per cent. by the imposition of a Reichert-Wollny number of 24; that is, out of every 100 samples of Dutch butter that come into this market each year, three of them might be affected by a Reichert-Wollny number of 24—you will find that in the minutes of our evidence. My point is that Russian and Siberian butters would not be affected in any greater degree by the imposition of the same limit?—I think it would affect much more than 3 per cent. of our butter produce. Besides, I think the time has not yet arrived when we could have such a standard as 24 Reichert-Wollny.

12428. That is another point?—But it is my opinion.

12429. I quite sympathise with you in your desire that the Siberian peasant should have time to turn round and accommodate himself to the imposition of restrictions of this kind. He pleads for time, does he not?—Yes.

12430. He has got a lot of agencies at work tending to ameliorate the conditions which produce the present state of things, and he asks for time to allow of the natural effects of the improved methods which are being gradually enforced in Siberia?—He does not think the time has arrived to make the change, and he thinks that the basis you arebuilding on would not be the right one for Siberian butter—not even in half a year's time. If specialists could find out an exact method of determining the dividing line between genuine butter and adulterated butter, then that would be a very different thing, and he would come over to you with the greatest pleasure.

12431. In the meantime, therefore, until some heaven-sent genius finds a method, we have to do nothing?—Then you do not think such a way could be found out?

12432. I have spent many months, with the aid of the very best assistants that I could command, in trying to perfect some method which should directly go for the substance which is used to adulterate butter, so as not to be obliged to make my deduction as to the validity of the butter by an inference such as we are obliged to do now, and as yet neither I nor any of the half-a-dozen men who have been working upon the same problem—some of them with the direct incentive of considerable money prizes offered by Governments—have been able to find any such method?—Therefore, the conclusion is that any basis you could adopt at present would be a wrong basis.

12433. That is a matter of opinion?—Yes.

12434. (*Mr. Anderson.*) Is sesame oil or any other oil of a distinctive character used in the manufacture of margarine in Russia?—I am not acquainted with all the stages in the manufacture of margarine, but I presume that sesame oil is not used.

12435. Its use is not made compulsory by the law which you read to us this morning, is it?—The law says that the margarine shall only be prepared by M. Mourier's method.

12436. What proportion of the butter made in European Russia and in Siberia is made in the winter?—About 25 per cent., roughly speaking.

12437. It is that identical 25 per cent. to which the low Reichert-Wollny numbers would apply more particularly than to the other 75 per cent.?—Yes, principally.

12438. I asked you one or two questions yesterday with regard to the method of feeding the cows; in the synopsis of your evidence it is stated that when the cows approach the end of the period of lactation they are very often put on a straw diet; is there any reason why they should be so fed?—The best food is given to the cow when it is at the best period of its lactation. When it yields most milk, then is the time when the best food is given to the cow; when it goes down, then they give poorer food to the cow.

12439. So that these two factors would tend to bring about the production of an inferior quality of milk?—When this happens, of course, there is not so much milk yielded, but that is the time when there is more fat in the milk.

12440. Does this system of feeding the cows interfere with the yield of good milk during the ensuing season?—I do not think it does, because afterwards, when the cow calves again, milk of the same quality comes on again with the good food.

12441. Are you familiar with the system of feeding cows in other parts of Europe?—Yes.

12442. How would the Russian system compare with the system prevailing in other dairying countries in Europe?—I think it is universally the case that when the cow is yielding most milk she gets most food, or food which is richest in proteids.

12443. I see that you have in Russia 2,500 associations, or factories, concerned with the making of butter?—Approximately that number, but I cannot give you the exact figure.

12444. Are a large proportion of those co-operative societies?—No.

12445. I understood from the Consular report which you have been examined upon, that a large proportion were co-operative societies. Can you say what proportion of those 2,500 factories is owned by the co-operative societies of farmers?—Where these creameries are the great majority belong to capitalists and private people; the others are owned by co-operative societies.

12446. You said yesterday that the system of buying milk at these creameries on the basis of the butter fats which it contains was not practised. I would like to know whether anything is done by the creameries or butter factories in Russia to encourage farmers, or to induce them, to practise better methods of feeding and housing their stock, so as to produce milk of a better quality?—I stated that such measures were being adopted by the dairy instructors, the *agronomes*, and by the societies. The chief things which they aim at are not only the enrichment of the milk with fat, but also the yielding of a larger quantity of milk.

12447. My question was whether anything was done by these institutions to encourage the production of a better quality of milk?—Some of the creameries have their own instructors, who help in that way also.

12448. At the creameries do they make a difference in the price between poor milk and rich milk?—As I stated yesterday, that will be done when the milk is purchased, as perhaps it will be in the future, according to its fat. The Russian Government has offered to give a sum of money to the person who will invent a cheap apparatus for use by the peasants themselves, so that the peasants can, before bringing in this milk to the creamery, ascertain whether it is rich in fat or not.

12449. Is there any standard for butter fat in milk in Russia—that is, any minimum below which pure milk must not go?—No, there is no Government standard, but each town or district has its own standard.

12450. I will take a case in point, and that perhaps will be better. You told us that some milks showed as high a percentage as 7?—Yes, that is so.

12451. Assuming that one farmer brought in a certain quantity of milk showing 7 per cent. of fat, and another farmer brought in an equal quantity of milk showing only 3·5 of fat; would both those men get the same price for their milk?—That would be impossible, because 7 per cent. is only got in the Altai province down towards the south of Siberia on the mountains, and the 3·5 is only to be obtained in European Russia.

12452. Perhaps that is rather an extreme case to give, but take a case which it is not impossible to conceive even in Russia where one man supplied milk containing 4 per cent. of fats and another man supplied milk containing 2·5 per cent. of fats; what would happen then?—Payment is not, as I have already said, regulated by fat; the price would be the same. But if it could be proved that the cream had been abstracted from the milk before it had been brought into the creamery, then it would be refused.

12453. Do you consider that that is a system calculated to raise the standard of the dairy industry of the country?—I answered that question yesterday by saying the system of buying by the fat was going to be introduced.

12454. We are dealing with things as they are, not as they are going to be. My question was whether this system was not calculated to prevent any improvement

M. Kalantar.

22 Jan. 1903.

in the production of milk, and consequently in the production of butter, in Russia?—The only thing that is wanted is pure milk, to which no water has been added and where the cream has not been taken off. If we can get those conditions we can always hope to get good results.

12455. Would you argue on those lines that any butter which was the natural product of cows badly fed, badly housed, badly managed, should provide a basis for all the butter made in Europe or sold in the British markets?—It has not proved by science that this butter, even taken under those conditions, is bad butter as regards its tasts and its market price. It would be bad if you were to consider it by the Reichert-Wollny figures, of course.

12456. (*Mr. Hickey.*) I want to be clear about these analyses. In the tables that you have furnished to the Committee you give analytical results of over 300 samples. In Table II. the analyses begin in November, 1901, and go on through December, January, February, March, April, May, June, July, and August, 1902. Under what circumstances were these butters made?—The Government instructors went about collecting this butter, packing it up, and sealing it, and sending it to St. Petersburg.

12457. Were these samples made from the milk of one cow or from the milk of herds of cows?—The latter.

12458. Would they be made from the milk of cows of small farmers or from the milk of cows of both small farmers and comparatively large farmers mixed?—Some of the herds consisted of several thousand head, and some only of tens—about 50 or 60.

12459. Therefore do you assure the Committee that these samples were perfectly pure butter—that is to say, free from any possibility of adulteration by the addition of foreign fat, although they are low in many cases in the Reichert-Wollny figure?—From the beginning to the end the butter was made in the presence of the Government instructors.

12460. I notice that 35 out of the 138 samples made in November, December, January, and February show less than 24 Reichert-Wollny?—There were 42 below 23 Reichert-Wollny.

12461. That is, 42 out of a total of 351?—Yes. In Table III. you will see it given according to the months.

12462. I rather prefer to take the individual samples in Table II.?—Table III. is based on Table II., so it is all right.

12463. Is it your evidence that about 25 per cent. of all the samples would come under a Reichert-Wollny figure of 24?—In November there were 50 per cent. below, in December 62 per cent., in January 52·5 per cent., in February 14·8 per cent., in March 7·4 per cent., in April 28·6 per cent., in May 10·2 per cent., in June they were all above, and in July there were 16·3 per cent. below.

12464. Roughly speaking, how many would you say come under a Reichert-Wollny figure of 24?—About 18 per cent.

12465. Will the fresh table that you handed in yesterday make any substantial difference in those figures?—It is not a new table.

12466. Were any of those butters referred to in Table II. bought on the public market, or were they all made in dairies in the presence of your inspectors?—Not a single one was bought; all were made in the presence of the dairy instructors.

12467. Please turn to Table VII. I understood you to say that the butters referred to in that table were made on very large estates in European Russia?—Yes, all private estates.

12468. Were the conditions under which the butter was made in those places far more favourable to the production of an article having a higher Reichert-Wollny figure than those referred to in Table II.?—These analyses shown on Table VII. are included in Table II.

12469. Then it is not possible to draw the inference that the peasant farmers could be brought up to something like the same level of manufacturing butter with a higher Reichert-Wollny figure than is the case at present?—The comparison you suggest can be made, but the conditions of the industry are very different in differents parts of the country, so that you cannot found your conclusions upon such comparisons.

12470. On these large estates I make out that about 21 per cent. of the 138 samples tabulated here contain a Reichert-Wollny number below 24?—Your question is answered in Table VII. (c).

12471. From that table it appears that 30 samples out of 140 samples fell under the Reichert-Wollny figure of 24; is that so?—Yes.

12472. Is it your evidence that it is practically impossible to make butter in Russia at the present time under more favourable conditions than what these butters were made under upon these estates?—The conditions of the cows on these estates are much better than the conditions of the Siberian cow; they have warm stabling, much better food, and to a certain extent the calving is better regulated.

12473. In your analyses of Siberian butter and Russian butter, have you found Siberian butter to show lower Reichert-Wollny figures than Russian butter?—You would naturally come to such a conclusion anybody would think that that would be the result; but it does not turn out so in reality, because this year the Siberian butter was much richer as regards the Reichert-Wollny number than the butter made in European Russia.

12474. To what do you attribute that?—To the hot summer in Siberia and to the very rainy, cold summer in European Russia.

12475. (*Mr. Dunn.*) At the foot of Table II. there is a note that "the R. W. No. of all samples taken in on the 30th of October, 1901, was 23·7"?—Yes, that is a mistake which has already been brought out. The column for October in Table III. should be omitted, and therefore also this note to Table II. The tables should begin from November.

12476. Would you object to a Reichert-Wollny number of 23 being taken as the standard?—It would be just the same if the standard were fixed at 26 or 20, because, in my opinion, the Reichert-Wollny number is not the right test to adopt for a standard.

12477. Have you a better standard to go by?—If you were to adopt a Reichert-Wollny number which would cause an absolutely genuine butter, which you knew beforehand to be genuine, to be looked upon as adulterated, that would be doing an injustice, because it cannot be adulterated when you positively know beforehand that it has not been adulterated.

12478. The same question affected the milk question which has been so often quoted here?—I have said this morning that the analogy between milk and butter is not complete, and Professor Thorpe was of the same opinion that it was not a full analogy. That is why I say my opinion is that some international measures ought to be taken.

12479. And while we are getting at that, we are to do nothing?—Measures ought to be taken against adulteration, and that is all.

12480. We ought not to have a standard under which pure butter, genuine butter, could be looked upon as adulterated. Of course, it is not absolutely looked upon as adulterated; it only raises a presumption that it is adulterated, which is not quite the same thing?—The Reichert-Wollny figure is not enough. I could send you samples of butter which would show a Reichert-Wollny figure of 20, and nevertheless that butter would be very good, because it would contain a certain percentage of olein which is not shown in the Reichert-Wollny figure, and which must be got at by Hubl's analysis.

12481. The reason why I mentioned 23 was that in Table III. (b) we find that there are 33 samples above 23, but that when you get below that figure a very small number only would be included?—Even now in the laboratories, with the methods at present existing, you could analyse butters and raise the same presumption whether they were genuine; but the moment you bring out a law that such and such a standard must be fixed, then that would be an altogether different matter, because then some genuine butter will be treated as adulterated butter, and that should not be the case, in my opinion.

12482. Are you altogether against a Reichert-Wollny standard?—It is impossible to found any absolute evidence upon the Reichert-Wollny figure alone.

12483. (*Mr. Gilchrist.*) Have there been lately many prosecutions of Russian butter in this country?—I only know of four cases.

12484. Were the prosecutions successful in bringing

M. Kalantar.

22 Jan. 1903.

home guilt to the parties?—No, they were all unsuccessful.

12485. Was anything paid towards the cost of the defence by the authorities in this country?—Yes; when the case was lost by the Crown, the costs were paid by the Crown.

12486. If that be so, under this presumption, if the same conditions were continued—that is, if butter with a low Reichert-Wollny number was to be prosecuted, and you had the chance of defending it, and of proving that it was pure and genuine, then, if you did prove that it was pure and genuine and got your expenses, would you have much to find fault with?—This happened only because there was no standard, but if a standard be fixed, it would be impossible to fight against it.

12487. I am not quite sure that you understand the standard that we fix. It is only a presumption that is raised that you are guilty until you have proved your own innocence. If we fix a standard, it will only raise a presumption which will give you the chance of proving your own innocence, such as you have had in these four cases?—But even last year or the year before, when these cases took place, three months passed by before the case was got through, and consequently a lot of time, energy, and money were spent by the British purchasers and consumers of the butter, and by the Russian dealers and shippers.

12488. In other words, you did not get your full expenses?—No, I do not mean that, but that the time was wasted.

12489. Are there any means by which you can prevent the exportation of this butter with a low Reichert-Wollny number to this country?—To do that you would have to analyse over a million casks of butter, so it would be impossible.

12490. (*Mr. Gibbons.*) Do any prosecutions take place in Russia on account of the butter having foreign fat added to it?—Such cases do happen with melted butter, *i.e.*, butter that has been heated to a certain temperature and then has had its temperature lowered again.

12491. (*Sir Charles Cameron.*) The question is, whether you have prosecuted for the foreign fats, suet, and lard?—Only with such butter.

12492. (*Mr. Gibbons.*) Would that butter be packed in tins?—No, it is packed in very large barrels. The greater part of this butter is consumed in Russia or sent to Turkey.

12493. Is there much consumed in Russia and much sent to Turkey?—Yes.

12494. Could your Russian experts determine whether there was 7 per cent. of margarine added to the butter?—No, it would be impossible.

12495. Can you give us any other reason for the immense addition to the exports of Siberian butter during the last three or four years, save the formation of the Siberian railway?—There is no doubt the Siberian railways were the chief factors in that.

12496. Is that increase likely to continue?—Yes, I think there is a great deal of evidence to show that it will continue. Some of it will go east towards China and Japan, owing to the railway, so the export will grow very largely.

12497. You told us just now that your cows are fed as in England in the winter time—very much on straw?—Not only on straw, but when the cow gets dry it is fed on a poorer food than during the time it is yielding milk.

12498. Are you aware that in England, when cows are fed with straw, we generally feed them also with good linseed cake, much of which comes from Riga?—Yes.

12499. Are the pastures in Siberia what we term old pastures, or are they formed by artificial grasses and clovers?—They are all natural, not artificial.

12500. Is the butter that is sent to England from Siberia made on private farms, or is it made by cooperative or by other public creameries?—Both exist.

12501. Which is the larger proportion?—The private farms form the majority.

12502. (*Mr. Hickey.*) Did I understand you to say that there had only been four prosecutions in England for the sale of Russian and Siberian butters within the past five years?—I only know of four.

12503. Have you heard of any cases of prosecutions against Russian butter being withdrawn pending the fixing of a Reichert-Wollny figure as a standard?—I know of one case.

12504. Is that the recent case that occurred at Kensington?—Yes.

12505. Speaking generally, has the fact of the prosecutions against Russian and Siberian butter been prejudicial to its sale in England?—I do not think it is a matter of prejudice. The chief reason is that it is founded on the decision whether the butter is looked upon as adulterated or genuine butter. It does not lie on the right basis.

12506. I think you have misunderstood my point—have the prosecutions that have taken place against Russian and Siberian butters affected the sale of those butters in England?—Yes.

12507. What grounds have been put forward for not using Russian butter so freely since those prosecutions were taken?—When I came over to England two years ago for one of these cases, I thought I was coming over for a couple of weeks, but instead of that I was forced to stay over three months. During that time when the case was being brought before the court, no dealers or exporters of Russian butter in Newcastle and all the other places would buy exported Russian butter until the court came to a decision; and owing to that the prices of the butter fell to a great extent.

12508. Would you not regard that as a reason for the fixing of a limit in connection with the sale of butter generally?—I am of the opposite opinion, because as soon as the standard is fixed, the Russian Government will not be able to prove that the butter is genuine if it is below a certain Reichert-Wollny number; it will be always looked upon as adulterated.

12509. Can you tell the Committee what is about the average difference in price between Russian butter on the London market and Danish butter per 112lbs.?—I do not know the Danish prices, but I think there would be, roughly, say, about 20s. difference per cwt.

Professor ACH. MÜNTZ, called; and Examined. (Mr. A. E. Balleine, the Secretary to the Committee, acted as Interpreter.)

Professor Ach. Muntz.

12510. (*Major Craigie.*) You are a member of the Institute of France, and Professeur-Directeur of the Laboratories of the Institut National Agronomique, Paris?—Yes.

12511. I understand that you attend here by the direction of the French Government?—That is so.

12512. We on this Committee, I should inform you, are directed by our Government to inquire simply with reference to the establishment of a standard in order to determine the question of the adulteration of butter. You have been good enough to prepare a statement for submission to the Committee as to the general composition of butter; in that paper you divide butter into two parts—first, the aqueous liquid; and second, the fatty matters properly so-called?—Yes, that is so.

12513. With reference to the aqueous liquid in butter, I gather that you are of opinion that it is not possible to make regulations regarding the expulsion of butter-milk or the washing of the butter?—I am. The definite composition of the watery liquid which remains in the butter cannot be fixed, nor is it necessary to examine it as regards the proportion of milk ingredients which it may contain. From a nutritive point of view this aqueous liquid must be regarded as without appreciable value, and the proportion of this liquid is therefore not without importance, inasmuch as the more water a butter contains, the less is the relative amount of butter fat, which is the real—one may say the only—nutritive matter in butter. The proportion of this aqueous liquid varies with the method of butter-making, the nature of the products employed, the care taken to get rid of the moisture, and the season of the year. When butter is manufactured legitimately, the proportion of liquid does not exceed a certain maximum. But it is possible, if not an easy matter, to introduce into butter a greater proportion of water than it contains naturally. It is therefore advisable to fix a limit for the aqueous

Professor Ach. Müntz

22 Jan. 1903.

liquid in butter; and as this liquid is almost exclusively composed of water, it will suffice to fix a maximum standard for water in the butter of commerce in order to prevent the adulterator from leaving an excess of water to increase the weight.

12514. When butter is manufactured under favourable conditions what percentage of water will it, in your opinion, contain?—From 11 to 13 per cent.

12515. In certain circumstances, especially in hot weather, may the quantity of water rise to 15, 16, or even 17 per cent.?—17 per cent. is very high—too high, in fact.

12516. You are aware that a standard has been fixed at 16 per cent. on the recommendation of this Committee; therefore we need not now discuss that question in detail?—I will only say that 17 is too high; it is altogether exceptional.

12517. I propose to ask you to give the Committee the benefit of your opinions with reference to the composition of the fatty matters properly so-called. What is the composition of butter fat?—Butter fat is composed of the glycerides of fixed and of volatile acids. Margarine and olein form the principal portion of the former; they present characteristics which are common to all fats of animal or vegetable origin, and it does not appear possible to regulate or fix limits for the relative proportion of their constituents. The most that could be done in this respect would be to regulate their absolute proportion, which varies in inverse ratio to the amount of the glycerides of the volatile acids. It is, however apparently better not to take them into consideration, but to consider only the examination of the glycerides of the volatile acids, of which the quantity indirectly determines the amount of the glycerides of the fixed acids. It is the glycerides of the volatile acids which must be specially taken into consideration.

12518. The proportion of these glycerides will vary very considerably in natural butter?—Yes.

12519. And therefore no manufacture, in your opinion, can produce butter of a fixed composition when nature herself refuses to produce it?—That is so.

12520. It should be understood that there are limits in which the variations will occur?—Yes. I am of opinion that it is desirable that certain limits should be fixed, so that the quantity of any adulteration may be known.

12521. I believe you are of opinion that the adulteration of butter by the addition of foreign fats can never increase, and can only decrease the proportion of the volatile acids?—Yes.

12522. Then your opinion is that it is necessary, or at least advisable, to fix a minimum limit for the volatile acids present in butter?—It is the only means of detecting the presence of margarine. It is really advisable to fix a minimum limit depending on the volatile acids, because they are the most important indicators of adulteration.

12523. Do you find that the fixing of that minimum limit is attended with considerable difficulty?—Very great difficulty. It is not the same in different countries, and it is not even the same thing in the same country with different breeds, different feeding, and different stabling. It differs in different parts of the same country, according to the various factors, such as food, season, etc.

12524. Great varieties exist in French butter taken by itself?—Yes.

12525. The Normandy butter, I understand, contains from 5·5 per cent. to 6·5 per cent. of volatile acids, and the minima in those cases would rarely fall below 5 per cent.?—Yes.

12526. Whereas in other parts of France, say Brittany and Central France, the volatile acids are in a somewhat lower proportion, generally ranging about 5 per cent.?—Yes.

12527. You would contrast those figures with the Dutch butters, which you suggest under exceptional circumstances fall as low as 4 per cent., and even less?—Yes.

12528. Your conclusion is that the French butters taken as a whole have a higher range of these acids than the ordinary Dutch butters that are imported into this country?—Yes; that is true, speaking generally. French butter is very rich in Normandy, and it is less rich in Brittany, in Central France, and in the southwest. Normandy gives butter that is the richest in the world in volatile acids. The general character of the French butter is that it contains a relatively high percentage of volatile acids, more especially when compared with butter of Dutch origin.

12529. Is there a French official standard fixing an absolute limit for those acids?—There is no limit fixed by law, but each expert determines for himself.

12530. But there is, nevertheless, a French official method of arriving at that figure?—There is an official method of analysis, but not an official standard.

12531. There is an official method, but there is no actual figure on which the limit is fixed?—That is so.

12532. As a matter of practice have you had many cases in France where the butter has been challenged on this point?—There have been many cases of adulteration and frequent convictions. The number of prosecutions depend to a large extent upon the discretion of the analyst. In some cases, as in Normandy, for instance, he is accustomed to very high figures, and relatively low figures would influence him in declaring a butter was adulterated. In Brittany and the central districts, the analysts are not accustomed to such high figures, and they pass butters which in Normandy would be declared as adulterated—that is, if they knew that they were local butters. In parts of France butters containing 5 per cent. of volatile acid are regarded as pure, whereas an analyst practising in Normandy would regard them as adulterated.

12533. I believe you have prepared two tables, Table I. (taking the figure 5 as the minimal limit) showing the amount of added margarine, as indicated on analysis, on the basis of the quantity of volatile acids, estimated either by the Reichert process, or by the French official method which was adopted by a committee of the French agricultural stations; and the second, Table II., indicating the quantity of margarine contained in adulterated butter on the basis of 5·5 per cent. of volatile acids as the minimum for pure butter?—Yes, and I hand in the tables:—

TABLE I.

Reichert No.	French Official Method. Butyric Acid.	Margarine.
	Per cent.	Per cent.
15	3·00	35·5
16	3·20	31·9
17	3·40	28·2
18	3·60	24·6
19	3·80	21·0
20	4·00	17·3
21	4·20	13·7
22	4·40	10·0
23	4·60	6·2
24	4·80	2·8
25	5·00	—
26	5·20	—
27	5·40	—
28	5·60	—
29	5·80	—
30	6·00	—
31	6·20	—
32	6·40	—

TABLE II.

Reichert No.	Butyric Acid.	Margarine.
	Per cent.	Per cent.
15	3·00	45·5
16	3·20	41·9
17	3·40	38·2
18	3·60	34·6
19	3·80	31·0
20	4·00	27·3
21	4·20	23·7
22	4·40	20·0
23	4·60	16·2
24	4·80	12·8
25	5·00	10·0
26	5·20	5·5
27	5·40	2·0
27·5	5·50	—
28	5·60	—
29	5·80	—
30	6·00	—
31	6·20	—
32	6·40	—

Professor Ach. Muntz.

22 Jan. 1903.

12534. If, for instance, there were a standard fixed of, say, 24 Reichert-Wollny, that would be equivalent on the 5 per cent. basis, to 4·8 per cent. of volatile acids, and would admit of the presence of 2·8 per cent. of margarine, and no more?—Yes. According to the French official method, 5 per cent. of butyric acid represents 25 Reichert-Wollny; and that is taken to represent pure butter. When a butter contains a quantity of butyric acid corresponding to a lower figure than 25 Reichert-Wollny, that indicates the adulteration of the butter by the addition of margarine. In a case of butter adulteration, where it amounts to only 3 or 4, or 5 or 6 per cent. of added margarine, no prosecution takes place.

12535. (*Mr. Hickey.*) Why?—Because of the doubt. It would be an act of intolerance when 5 is the general limit, because it is conceivable that owing to accidental circumstances a butter might be produced which was a little below the 5 per cent. of volatile acids. Prosecutions only take place in France when the analysis shows an addition of 10 per cent. of margarine, equivalent to 4·4 of butyric acid or 22 Reichert-Wollny.

12536. (*Major Craigie.*) You are, I believe, of opinion that the fixing of a minimum limit is desirable in the interests of French and other butter?—Yes.

12537. Would you fix your minimal limit on the volatile acids, or would you prefer to take the rough empirical indication of the Reichert-Wollny?—It is indifferent as regards a standard.

12538. You would draw no distinction between those two for that purpose?—That is so.

12539. You are in favour of fixing a limit; and if you had to fix the limit, either on the one scale or on the other, what is the figure at which you would fix the proper limit for raising the presumption that the butter was not genuine?—4·5 would be the limit I would suggest as the fair limit. That would correspond with 22·5 Reichert-Wollny.

12540. Is it your opinion then that you would make the minimal limit as low as 22·5 Reichert-Wollny?—Yes. That limit is too low perhaps for ordinary butter, but you may find a natural butter with as low a limit as that. 22·5 is the lowest I would suggest; it would prevent injustice being done in any case; but I think that it is too low for certain butters.

12541. What higher number than 22·5 would you consider as practically doing no injustice to French butter manufacturers and importers?—That is a matter of opinion, not of ascertained fact. If I find 5·2 per cent. of volatile acids I should think that butter was adulterated if it came from Normandy; but if a butter, for instance, from Brittany of the Charentes shows 4·7 or 4·8 I should have hesitation in declaring it to be adulterated. It all depends upon the local conditions.

12542. Supposing this Committee were to fix one number under which the presumption that the butter was not genuine would arise—one number only applying to all butters—at what figure would you place it?—I am the official adviser, the referee, to the French Government in cases of doubt; if I find that a butter contains less than 5 per cent. of butyric acid, I take that as an indication of adulteration; but I do not declare it as adulterated unless it is below 4·5.

12543. That is equivalent to 22·5 Reichert-Wollny; so that your opinion would rest somewhere between 22 and 23 Reichert-Wollny, if there was a single standard?—Yes. In my official capacity I may give a certificate showing whether the butter is adulterated or not; and when the case reaches the law courts the butter merchant has the opportunity of referring to another expert, who may declare that a butter with a Reichert-Wollny number of 22·5 is not necessarily adulterated, and that pure butter may show as low a figure as 21.

12544. That is after the case has been brought into Court?—The police may take samples of butter, and in the case of doubtful samples they are referred to the Government expert, who must make his analysis and report within eight days; and it is within those eight days that the butter merchant can call in a second expert; but the case has not reached the Courts yet.

12545. Then it is before a prosecution is commenced that the appeal to a second expert is permitted?—Yes. Three samples are always taken.

12546. (*Sir Charles Cameron.*) Do you act for the whole of France?—The whole of France is divided into certain districts, for each of which there are experts; I am expert for Paris, but, nevertheless, samples may be sent to me from any part of France.

12547. You have devoted personal attention to the subject of butter analysis, and have personally conducted butter analyses?—Yes.

12548. About what number of specimens in a year will come under your own observation?—It varies very much from one year to another. Some years I may have from 200 to 300; in other years very few.

12549. In an average year would they come to 100?—In certain years they will do so; at other times I should get only 50 or 60. The first few years after we legislated on the butter question there were very many more than now, because adulteration was then very prevalent. I am referring to the years which immediately followed the Margarine Law of 1897. The number has been considerably reduced since, on account of the decrease in adulteration.

12550. Have you examined specimens of butter of undoubted purity?—Yes. Even before the law of 1897 I was selected to make an inquiry into the composition of pure butter; that is, butter which was known to be pure. The directors of various provincial agricultural schools supplied the specimens, so that there was no doubt of its purity.

12551. Were your samples taken from different parts of France?—They were taken from all parts of France.

12552. Roughly, how many samples were there?—80 or 100.

12553. Were they examined by the Reichert-Wollny method?—They were examined by the French official method, which corresponds very closely with the Reichert-Wollny method.

12554. What you estimate in terms of butyric acid includes the other volatile acids—caproic, caprylic, and butyric?—Yes, it is all calculated as butyric acid. The French official methods includes all the volatile acids.

12555. What is the lowest amount of butyric acid that you have met with in any undoubtedly pure sample of butter?—4·6 is the lowest I have found; and I have found that value once or twice.

12556. That would be a little over 23 Reichert-Wollny?—Yes.

12557. Where does the butter come from?—This was butter from the Charente in the west of France.

12558. As an expert and specialist, do you think that the flavour and superior quality of butter depends upon the amount of the fats that contain the volatile and soluble acids—butyrin, caproin, and so on?—Very much; the quantity of the volatile acids influences to a great extent the quality of the butter—the greater the quantity of these volatile acids the better the flavour and the aroma. The methods of manufacture, the condition in which the butter has been kept, and its freshness have also considerable influence in this respect.

12559. Taking two samples of butter from two parts of France, one containing the minimal amount of the valuable soluble acids, the other containing the maximal amount; have you sometimes found the former to be as good as the latter?—No, never; but when the pasture is good, the proportion of volatile acids varies considerably in those districts where it is generally low.

12560. Are there any points in regard to the production of the butter, the management of the dairy, the nature of the cows, the nature of the food, which might determine the quality of the butter as well as the proportion of the volatile acids? It has been stated that the amount of volatile acids in butter bears no relation whatever to its quality, or to the price it commands in the market; I take it that commercial value depends upon intrinsic value, upon its quality and good flavour. Do you think that good management in the manufacture of butter and other conditions, such as the breed of cattle and the food supplied to them, would have as much influence upon its quality as the amount of volatile acids?—I do not agree with the statement that there is no connection between the amount of the volatile acids and the commercial value of butter.

12561. Do you think that the quantity of the volatile acids is influenced by any exterior conditions?—Yes; the cold affects the proportion of the volatile acids very much.

12562. Would the amount of the volatile acids be affected by the skill in the management of the butter-making such as setting the cream and all the other manipulations in the manufacture of butter?—No, it is not affected by dairy methods of manufacture.

Professor Ach. Müntz.

22 Jan. 1903.

12563. Has it been determined by experimental research whether a butter made in the same locality, and of the same quality, must always contain the same amount of volatile acids; or whether, on the other hand, you may have two samples of butter of unequal quality, and yet both may contain the same amount of volatile acids?—That need not necessarily be so, because one may be the product of a rich pasture and the other of a poor pasture.

12564. What would the superiority be due to?—Especially to the feeding. In the same department you will find good pasturage and good butter, and bad pasturage and bad butter. The question is mainly differentiated by the question of the food, but the good method of making and keeping butter have also much influence on its taste and fineness.

12565. Is that opinion based upon experimental evidence?—Yes. The better butter invariably contains a larger quantity of volatile acids.

12566. And that has been determined experimentally?—I have made an inquiry into the subject, but I have not published the results as yet. I have myself tested samples of butter, and I have found in every case that the better butter contained the larger quantity of volatile acids.

12567. In making your analysis, not according to the empirical Reichert-Wollny method, but by determining the amount of soluble fatty acids, do you check the results by also determining the amount of the insoluble acids?—No.

12568. Do you not weigh the insoluble acids as a confirmatory test?—I may do so, but the determination of the volatile acids is a much more certain test than the determination of the fixed insoluble acids.

12569. Dealing with the same sample of butter, have you used both the Reichert-Wollny method and the direct determination of the soluble fatty acids, and have you, as a matter of your own personal experience, found them to agree?—The official method is imposed upon French analysts, and the Reichert-Wollny method is not used even as a control. The two methods are concordant methods; and so it is considered unnecessary to use both.

12570. (*Professor Thomson.*) Do I understand that you would recommend the fixing of a standard?—Yes, I believe that it would be useful to fix a limit, if the limit be sufficiently low to prevent prosecutions in the case of samples of pure butter.

12571. Could you, from your experience of French butter, give the Committee any idea of the amount of that butter which comes below 24 Reichert-Wollny?—The larger proportion of French butter would not come below 24 Reichert-Wollny. A notable quantity of the butter of Brittany, and a part of the butter of central France, would come below it.

12572. What percentage of the butter would you say would come below that number—5 per cent.?—More than that, I think, but it is very difficult to say. Perhaps 10 or 20 per cent. might fall below 24 Reichert-Wollny.

12573. That figure is very different from the figure that we have heard of in connection with other countries, even in connection with Holland?—It is only my impression.

12574. Do you think that this failure to reach 24 in Brittany, for instance, depends entirely upon the feeding, or the bad stabling, and the other circumstances under the control of the farmer?—It is principally due to bad conditions of feeding.

12575. And not to the stabling would you say?—That cannot affect the composition of the butter; that may affect the flavour of the butter, but not its chemical composition.

12576. Supposing a standard of 24 Reichert-Wollny were fixed, do you think that that would induce the farmers in Brittany and similar parts of France to improve the conditions under which they keep their cows?—No, that would not be possible. It is not within their power to alter the conditions of the feeding.

12577. Would it not induce them to give better artificial feeding?—They have not any better food to give; they are limited to their local supplies.

12578. Do you think that 24 would be too high, and that 23 would be more generally accepted?—No, because even then it would happen that some pure butters would be regarded as adulterated. If the figure is to be taken as the point at which merely a presumption of adulteration is to be raised, then I think 24 Reichert-Wollny is not too high a number to fix.

12579. Do you think that the Reichert-Wollny number alone might be taken, or that some other test should be added?—In a case of doubt it would be a very useful thing to call in aid the Koettstorfer saponification index, and also to ascertain the co-efficient of solubility in absolute alcohol. When these two tests give results in due proportion to the volatile acids, one can say whether the butter is pure or adulterated.

12580. In ordinary cases, would you say that the one test of the Reichert-Wollny number is sufficient?—In cases where there is no doubt at all the Reichert-Wollny number is quite sufficient; in cases of doubt, as corroborative tests, I should suggest that you should ascertain the Koettstorfer number and the co-efficient of solubility in absolute alcohol.

12581. (*Mr. Anderson.*) Is there much margarine made in France?—A very large amount.

12582. I believe it is made under Government supervision?—Its manufacture is under the control of the State. All the factories are supervised by agents of the State. No maker of butter, and no retailer of butter, can sell margarine and butter in the same shop. Margarine can be sold by grocers or butchers, or other persons who do not sell butter.

12583. Is there any ingredient added to margarine in the process of manufacture so as to distinguish it from butter—sesame oil, for instance?—No, the French margarine manufacturer is not obliged to add any distinguishing oil, but a Bill on the subject will soon be presented.

12584. Can you tell the Committee whether there is any inducement offered to the French farmer to improve the quality of his milk by better methods of feeding and housing, and by improvements generally in the care of his milch cows?—No.

12585. Is any such encouragement given by the butter factories or by the creameries?—There are butter and dairy schools and creameries which give instruction in the proper manufacture of butter, and there are also itinerant inspectors who give lectures to the farmers; but there is no direct help given to them.

12586. Are there what we call creameries in France?—Yes; they are called fruitières. There are many of them in certain regions of France—in Doubs, for instance, in the East. There are two or three districts where there are creameries, where the milk is brought to the creamery, and the butter is made from the milk.

12587. Is the system of purchasing that milk one which is based on a percentage of the butter fats which that milk contains?—The price is based on the quantity of milk supplied, but the milk is tested so as to ensure its purity.

12588. Is the milk paid for in accordance with its quality?—No. There is not a great difference in the quality of the milk supplied. It is generally brought from the surrounding district, and it is therefore of practically identical composition.

12589. Has that uniformity been brought about by the fixing of any milk standard?—Generally speaking in the same district they have similar pastures, similar breeds, and the conditions are altogether identical. The uniformity of the milk is due to the uniformity of the conditions under which it is produced.

12590. I should like to ask you how far the period of lactation affects the Reichert-Wollny number in butter?—It has an influence, but that influence is not very great.

12591. Is that not a condition which is absolutely under the control of the farmer?—Yes; but taken as a whole, it does not affect the quality of the milk very much, because, of course, the cows are not all calving at the same time.

12592. Does the process of blending the butter which goes on very largely in France in any way interfere with the results of analysis as regards the Reichert-Wollny number? Would there be any difference between the Reichert-Wollny number of a butter produced from a certain district under the same conditions, if that butter were produced (1) in a creamery, and (2) in the peasant dairies, and then re-blended and sold as factory butter?—No, but there would be a difference in the taste—the bouquet. The act of mixing one butter

Professor Ach. Müntz.

22 Jan. 1903.

with another butter would have no influence on the Reichert-Wollny number, but it might have an influence on the aroma.

12593. Of course, there is a direct relation between the flavour of the butter and the Reichert-Wollny number; when the Reichert-Wollny number is low the flavour of the butter would be also poor?—Yes.

12594. Would there not be an inducement where the factory system is practised to purchase butter with a high Reichert-Wollny number and blend that with butter which showed a lower number?—That practice does not exist in France.

12595. If butter were kept for a very long time after it is made, say for three or four months, either in transit or in store, under improper conditions, that is to say, without refrigeration, would it not be possible that that butter would show on analysis, a lower Reichert-Wollny number at the end of that period than it showed at the commencement? As an expert, can you tell us whether when butter is kept, the keeping has any effect on the Reichert-Wollny number; assuming, for instance, that the butter showed a Reichert-Wollny number of 28 when it was put into storage or started on its journey, how far would it be possible for that number to be affected during transit or storage?—There would be no difference; the butter would not be altered. Frozen butter, or butter kept in an air-tight bottle for several weeks, shows no difference in the volatile acids. The butter may even become absolutely bad, but the quantity of volatile acids remains the same.

12596. (*Sir Charles Cameron.*) But the putrefaction would make putrefactive changes?—Yes. It is only after the butter has become absolutely altered that a difference in the Reichert-Wollny number is observable.

12597. (*Mr. Anderson.*) Then may we take it that the Reichert-Wollny number is constant, and that if at the time of manufacture it is 28, it should still be 28 at the time the butter is exposed for sale, even if that happens three months afterwards?—It would remain at about 28; the figure is constant.

12598. (*Mr. Hickey.*) Does any foreign butter go into France?—Very little. During the last two or three years there has been a little Dutch butter and also a little Italian butter imported.

12599. In your professional experience have you had samples of any considerable number of foreign butters for analysis?—I have examined Dutch and Italian butters.

12600. At what time of the year have you found the lowest Reichert-Wollny figures in your French butters?—Always at the beginning of winter; that is, in the months of November and December.

12601. When do the cows calve in France?—There is no fixed time for that; the period varies very much.

12602. Have you found in your experience pure French butter with a lower Reichert-Wollny figure than 24?—Yes—about two or three per cent.

12603. (*Mr. Dunn.*) It is a well-known fact that in Paris there are butters sold at prices almost unknown in any other part of the world, like 2s. 6d. per lb.; have you examined those butters to ascertain whether they contained a very high proportion of the volatile acids or not?—Yes. It is Normandy butter which is sold in Paris at that high price. All Normandy butter, with very few exceptions, contains a high proportion of volatile acids.

12604. I presume that all Normandy butter does not bring this extravagant price, unknown in the rest of the civilised world, of 2s. 6d. per lb.; have you examined the butter that sells in Paris at this fancy price to ascertain if it contains an abnormally high percentage of volatile acids?—Yes; it does contain a high proportion, but not greater than Normandy butter in general. This butter is sometimes dearer, not because it is higher in volatile acids, but on account of its taste. But the price and the quality are not due to the amount of volatile acids alone; they are also due to the flavour—the aroma.

12605. Are not the flavour and the aroma due to something?—The aroma is due to other causes than to the volatile acids. One finds always the best aroma in butter which has a high percentage of volatile acids, and such butter is, on an average, of good quality. The aroma is found in butters which have a high proportion of volatile acids, but the volatile acids are there, owing to the good state of the pasture.

12606. (*Sir Charles Cameron.*) They are always there when the flavour is good, but it is not due to them?—It is due to the pasture.

12607. It must be due to some physical constant?—From the point of view of the chemist, I cannot say anything on that. It is the same as if one bought a bottle of wine, and asked to what was due the superiority of Chateau Lafitte.

12608. (*Mr. Dunn.*) You have satisfied yourself by experiments that a high percentage of volatile acids means an excellent quality of butter?—It is always remarked that that which has a superior taste has most volatile acids. There is no doubt about that.

12609. Their presence is an indication?—Yes; moreover, there is the question of care in making and preserving the butter.

12610. Is not the flavour largely due to the system of ripening the cream?—Yes. In Denmark they work with a sour cream, and the butter has a slightly acidulated taste.

12611. Does the variation in the system of ripening the cream vary the percentage of the volatile acids?—It influences the aroma and the taste, but not the proportion of volatile acids.

12612. What figures would you recommend as the Reichert-Wollny limits?—For French butter I should suggest 22 to 23 as the limit to include the low pure butters; but 24 for the purpose of raising the presumption.

12613. (*Mr. Gilchrist.*) Does the law in France in the case of prosecutions raise a presumption in the same way as the law does here?—No, there is no presumption at all, but a positive assertion. It is left to the analyst.

12614. Suppose an honest producer of butter in France was found to be producing butter which only contained volatile acids equal to a Reichert-Wollny number of 22; would that producer be fined, and have no way of getting off, although he proved that it was honest, genuine butter?—Not always, because he can employ an expert, who would be very indulgent to him, and he could retain a clever advocate. There is no fixed figure, so that it does not follow that if a butter indicates even 22 it would be condemned.

12615. (*Sir Charles Cameron.*) The question is, when it is admitted that that is the figure, would the maker of the butter be fined, although he proves it is genuine butter without any analysis proving the contrary?—One never knows in France what the result of a trial will be, as there is no fixed figure, and a good lawyer will obtain an acquittal where a less clever advocate would fail to do so. If a suspected sample of butter is declared pure by a second analysis, the case falls through.

12616. (*Mr. Gilchrist.*) Then it means in France that it is only a presumption, just as it is here?—There is no presumption.

12617. (*Sir Charles Cameron.*) Some analysts might, according to circumstances, have a higher figure, and say, below that it is adulterated?—Yes.

12618. (*Mr. Gilchrist.*) Are there any Dutch butters imported into France, and coming under your notice?—Yes, I have examined some samples.

12619. Have there been any prosecutions of Dutch butters that have come under your notice?—No, but at Lille they had a good deal of butter from Holland, and the French experts found the Reichert-Woolny number was very low—19 to 20; so this butter was condemned. Then the Dutch, through their chemist, proved that their butter sometimes was low in volatile acids; and on appeal they were acquitted.

12620. Then it will follow that in France you will come to treat Dutch or Italian butters by a lower standard?—Yes. A little latitude is allowed the Dutch butter on that account; but very little butter comes from Holland. It has been shown that those low figures are only produced in certain months of the year—October or November, and, even then, under quite exceptional conditions. This butter is, moreover, very inferior in quality.

12621. I notice that you have very easily translated the French official figures into the Reichert-Wollny figures; do you consider that translation a fairly correct one for us to go by?—Yes. The French official method gives the actual quantity of the acid contained in butter, and in that respect it is more scientific and preferable to

Professor Ach. Muntz.

22 Jan. 1903.

the Reichert-Wollny method, which is an empirical method.

12522. As a matter of fact, in treating French butters I understand there is no prosecution unless the butters fall under a number equivalent to the Reichert-Wollny figure of 22·5?—Yes.

12523. (*Mr. Gibbons.*) Is there any examination by experts, or any grading of the butter that comes into your Paris market?—There is no market brand, but many of the French manufacturing firms brand the packages at their factories.

12524. I want to know how these gilt-edged butters that we hear so much about at 2s. 6d. a lb. are distinguished, and what is it that differentiates them from those butters that are sold at half the price or less than that?—The name of the place where it is made, and of the manufacturer is marked on the package; it is then sent to Paris, the name is known, and it is sold according to the mark. Each manufacturer has generally three brands, first, second, and third; and each packet has corresponding colours, *e.g.*, red, green, and black respectively.

12625. Have you any standard for water in butter?—No, there is no official limit fixed to the amount of water in butter, but in case of excess of water above 17 per cent., for instance, prosecutions take place.

12626. Do geological formations in France form any important factor in the quality of the butter?—Yes, their influence is very great. That is the reason why Brittany, with its siliceous soil; deficient in lime and phosphoric acid, produces much poorer butter than Normandy, with its rich alluvial soil, or calcareous marl rich in lime and phosphoric acid, *i.e.*, soils producing fine and nutritive herbage. On granite soil the butter is always inferior, and on volcanic soil it is always superior.

12627. Is the largest quantity of the finest butter made in the farmhouses or not?—Much the greater part is made on the farms. The farmers take their butter to the markets or to the factories, where it is tasted and marked according to quality.

12628. (*Mr. Hickey.*) In the event of a prosecution taking place in France in the case of French butter, is it easy to trace back the butter to the farm where it was made?—No, because the dealers intervene and mix the various butters up into three qualities. It is necessary to add that the farmers never adulterate with margarine. I have never known a case where such adulteration has taken place on a farm. Adulteration is occasionally practiced by the small butter dealer, but never by large and well known firms.

12629. (*Sir Charles Cameron.*) This Committee beg to express their obligations to you and to your Government for having so fully acquainted them with the position of this question in France?—I am very glad that I have been able to render any assistance to the Committee.

APPENDICES.*

* No.	Handed in or Supplied by	See Question:—	Subject.	Page.
XXI.	Mr. H. Droop Richmond	9004	Tables shewing the variation in the Reichert-Wollny number, &c., of butter.	481
XXII.	The Representatives of the Netherlands Government	9074	Tables giving particulars of samples of genuine Dutch butter.	482
XXIII.	Ditto ditto	9085	Dutch butter control stations.	484
XXIV.	Mr. E. W. T. Jones	9580	Table showing variations between genuine and adulterated butter.	485
XXV.	The Representative of the Norwegian Government.	9729	Table showing the Reichert-Wollny number and the Refractive Index of Norwegian butter.	486
—	Ditto ditto	—	Diagram illustrating the Reichert-Wollny number of Norwegian butter.	487
—	The Representative of the Danish Government.	—	Microphotographs illustrating "dry" and "weeping" samples of butter.	490
XXVI.	Ditto ditto	9895	Report of the composition of Danish butter.	491
XXVII.	Ditto ditto	9924	Table relating to 26 samples of Russian butter below 25 Reichert-Wollny.	504
XXVIII.	Ditto ditto	9946	The Control of Danish butter.	504
XXIX.	Dr. T. E. Thorpe, C.B., F.R.S.	—	Report on an Official Inquiry into the composition of butter produced in the United Kingdom.	505
—	Ditto ditto	—	Diagrams illustrating the above Inquiry:—	
			(1) The influence of the Lactation Period on the Reichert-Wollny number.	507
			(2) The Reichert-Wollny number; The Specific Gravity; The Koettstörfer number; The Zeiss figure at 45° C.	
			of English samples;	509
			of Scotch samples;	533
			of Irish samples;	553

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* See also Appendix V. in the Interim Report (p. 294): A Table showing the Reichert-Wollny figures of 80 samples of Irish butter, 1894-6.

No.	Handed in or Supplied by	See Question:—	Subject.	Page.
XXX.	Dr. T. E. Thorpe, C.B., F.R.S.	—	Tables of analyses of samples collected for the above Inquiry, showing:—	
—	Mr. G. Lewin, F.I.C.	10568	I. The Reichert-Wollny number.	577
			II. The percentage of Butter Fat.	578
			III. The Water, Curd, Salt, and Fat.	579
			IV. The Soluble and Insoluble Acids.	583
			V. The mean Molecular Weight of the Insoluble Acids.	584
			VI. The Zeiss figure at 45° C.	585
			VII. The Specific Gravity.	586
			VIII. The Koettstörfer number.	588
XXXI.	Mr. G. Lewin, F.I.C.	10665	Analyses of Russian butter.	589
XXXII.	The Representative of the Russian Government.	12367	Tables of analyses of samples of Russian butter, showing:—	
			Table I. (A) The Reichert-Wollny Number, &c.	591
			" (B) The Reichert-Wollny Number, &c.	599
			" (Supplementary).	605
			Tables II.-X. (R.-W. values).	626
			Table XI. (Refractive index).	635
			" XII. (Iodine number).	635
			" XIII. (Hehner number).	635
XXXIII	Major P. G. Craigie, C.B.	—	Tables relating to the Imports of butter into the United Kingdom, 1896–1902.	636
XXXIV.	Mr. A. E. Balleine	—	Report on a proposed International Dairy Conference.	638
XXXV	——	—	Dairy Legislation in Austria-Hungary, Belgium, France, Germany and Holland.	640

APPENDIX XXI.

Appendix XXI.

Handed in by Mr. Droop Richmond, F.I.C. Q. 9004.

Tables Showing Variation in the Reichert-Wollny No., &c. of Butter and Margarine.

Table I.

——	Mean.	Variations.	Margarine.
Reichert-Wollny figure	28·4 c.c.	21·2 c.c. to 35·0 c.c.	0·0 c.c. to 0·3 c.c.
Insoluble fatty acids	87·75 per cent.	85·6 per cent. to 89·6 per cent.	95 per cent. to 96 per cent.
Soluble fatty acids	5·58 per cent.	4·6 per cent. to 7·0 per cent.	trace
Refraction at 35 degrees C.	46·0 degrees	43·8 degrees to 49·0 degrees.	52 degrees to 56 degrees.
Iodine absorption	37·4 per cent.	31·6 per cent. to 42·0 per cent.	50 to 60 per cent.
Density at 37·8 degrees C.	0·9117	0·9105 to 0·9122	0·901 to 0·903
Potash absorption	22·58 per cent.	22·01 per cent. to 22·98 per cent.	19·1 to 19·6 per cent.

Table II.

Reichert-Wollny No.	English Butter.*		French and Italian Butter.*		Danish, Swedish, &c.*	
Above 33	-	-	5	1·6 per cent.	—	
From 32 to 33	3	1·5 per cent.	9	2·8 ,,	1	1·0 per cent.
,, 31 to 32	8	4·0 ,,	27	8·4 ,,	1	1·0 ,,
,, 30 to 31	16	8·0 ,,	53	16·5 ,,	7	6·0 ,,
,, 29 to 30	25	12·5 ,,	77	23·9 ,,	23	19·8 ,,
,, 28 to 29	32	16·0 ,,	81	25·2 ,,	27	23·3 ,,
,, 27 to 28	42	21·0 ,,	44	13·7 ,,	25	21·6 ,,
,, 26 to 27	44	22·0 ,,	23	7·1 ,,	13	11·2 ,,
,, 25 to 26	16	8·0 ,,	3	0·9 ,,	5	4·3 ,,
,, 24 to 25	11	5·5 ,,	-	-	4	3·4 ,,
,, 23 to 24	3	1·5 ,,	-	-	2	1·7 ,,
,, 22 to 23	-	-	-	-	4	3·4 ,,
,, 21 to 22	1	0·5 ,,	-	-	4	3·4 ,,

* *The left column indicates the number of samples.*

Table III.

R. W. No.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Above 33	–	–	–	2	2	-	1	–	-	–	–	–
From 32 to 33	–	2	3	3	3	–	1	–	–	–	–	
,, 31 to 32	1	1	9	5	5	3	3	–	4	4	1	1
,, 30 to 31	6	8	14	4	23	6	7	–	2	4	2	1
,, 29 to 30	11	14	24	17	10	11	7	2	1	9	8	9
,, 28 to 29	19	15	15	9	16	7	10	6	3	12	20	13
,, 27 to 28	23	8	9	8	8	5	6	6	4	7	19	9
,, 26 to 27	6	3	8	2	1	1	4	9	11	12	9	12
,, 25 to 26	3	1	4	1	2	1	2	5	2	–	1	2
,, 24 to 25	–	2	–	–	1	-	2	4	4	–	3	–
,, 23 to 24	–	–	1	–	–	–	1	–	–	1	1	1
,, 22 to 23	–	–	–	–	–	–	–	–	–	4	–	–
,, 21 to 22	–	–	–	1	–	–	–	–	–	3	1	–
Total	69	54	87	52	71	34	44	32	31	56	65	48
Average, R. W.	28·2	28·7	28·6	29·2	29·7	28·8	28·6	26·8	27·4	27·5	27·7	28·1

Table IV.

Refractive Index at 35 degrees.		Reichert-Wollny figure.
49·0 degrees	corresponds to	23·0 c.c.
48·0 ,,	,,	24·7 c.c.
47·0 ,,	,,	26·3 c.c.
46·0 ,,	,,	27·9 c.c.
45·0 ,,	,,	30·2 c.c.
44·0 ,,	,,	34·0 c.c.

Appendix XXII.

APPENDIX XXII. (A).

(Information supplied by the Dutch Government). Q. 9074.

PARTICULARS OF SAMPLES OF GENUINE DUTCH BUTTERS.

The Reichert-Wollny Figures of Butter from the Factories belonging to the Association of Co-operative Butter Factories in Friesland.

Statement by the Government Agricultural Experiment Station at Hoorn.

The Samples were taken by two impartial and trustworthy persons, who assisted at the Churning of the Butter.

Factory.	DATE OF RECEIPT OF THE SAMPLES.												
	1900.	1900.	1900.	1901.	1901.	1901.	1901.	1901.	1901.	1901.	1901.	1901.	1901.
	17–27 Oct.	12–28 Nov.	12 Dec.	14 Jan.	28 Feb.	29 Mar.	3 May.	20 May.	11 June.	12 July.	3 Aug.	22 Aug.	4 Sept.
1	26·2	28·0	29·4	28·9	31·3	33·4	31·5	31·1	29·4	30·0	28·2	28·5	27·0
2	24·4	26·1	27·2	27·8	31·5	33·0	31·4	30·6	28·2	28·7	27·2	27·4	26·7
3	25·5	25·6	26·9	27·6	29·5	32·1	31·1	31·1	28·1	29·3	27·0	26·5	27·1
4	25·8	26·1	27·7	27·1	29·9	32·6	31·4	30·7	30·0	29·9	28·6	28·8	28·6
5	26·0	26·4	27·8	27·2	29·3	30·5	30·4	28·9	29·2	29·7	28·1	27·6	27·6
6	25·4	26·5	28·5	28·5	30·3	31·9	30·8	31·0	28·9	29·7	28·0	28·1	28·4
7	24·2	23·8	26·2	26·4	29·2	31·0	29·9	31·0	29·1	29·1	27·0	25·9	25·2
8	25·4	28·1	29·7	–	–	–	–	–	–	–	–	–	–
9	27·7	28·0	28·1	28·4	31·1	33·2	31·7	32·3	30·1	31·2	29·6	28·2	28·5
10	25·9	28·7	29·2	27·0	28·8	31·1	31·6	29·9	28·8	28·6	26·3	26·9	27·3
11	–	–	–	–	–	–	–	–	–	–	–	–	26·7
12	24·8	25·8	27·7	27·8	28·7	32·0	31·4	31·6	29·4	29·9	27·3	28·4	27·4
13	24·4	25·8	26·9	28·3	32·2	32·7	31·9	30·8	28·5	29·8	27·6	28·2	26·9
14	23·1	24·0	26·1	25·9	29·2	30·8	30·5	30·8	30·2	30·0	26·7	26·0	26·1
15	26·9	24·2	26·0	27·0	30·6	31·7	30·9	32·0	30·3	29·3	27·2	27·5	26·6
16	24·7	23·1	25·5	25·6	28·4	30·3	31·2	31·7	29·7	31·0	28·5	27·3	27·5
17	25·3	27·7	29·0	28·1	30·4	31·2	31·4	31·5	31·0	30·0	28·7	28·8	27·1
18	25·6	26·1	27·4	27·2	30·6	33·3	31·9	31·0	29·9	30·3	29·1	28·9	27·6
19	25·8	25·6	28·1	27·5	30·0	32·5	31·2	30·5	30·2	30·3	28·7	29·6	27·6
20	24·9	23·8	26·5	26·5	29·3	30·9	31·4	31·4	29·3	29·1	27·3	27·2	26·6
21	24·9	26·0	27·0	27·3	30·2	31·5	29·7	30·2	29·2	29·5	28·5	28·5	28·0
22	24·6	26·5	27·7	28·0	31·7	33·0	32·2	31·1	31·7	29·8	28·1	27·6	27·2
23	26·6	28·4	29·5	30·1	30·6	30·6	32·1	30·0	29·2	29·7	28·0	26·4	27·1
24	27·4	28·1	29·2	29·5	29·9	31·0	32·3	32·5	29·3	30·8	29·7	28·4	27·1
25	22·6	22·1	26·1	25·3	29·2	31·9	31·6	32·7	28·0	27·0	26·4	26·1	26·0
26	–	–	–	–	27·5	30·0	31·9	31·8	28·0	28·6	27·4	26·8	26·4
27	–	–	–		–	33·1	31·4	31·2	29·3	29·1	28·1	26·8	26·5
28	25·3	26·0	27·9	25·9	27·8	29·6	30·6	31·8	28·2	29·8	26·1	27·5	26·0
29	26·5	26·9	27·7	28·7	30·7	32·7	32·1	32·5	30·5	29·9	30·6	28·8	27·2
30	27·5	29·8	29·6	29·9	30·0	30·0	31·5	30·6	29·2	29·1	28·3	27·8	27·4
31	–	–	–	–	30·4	31·6	30·8	31·5	30·3	28·6	26·1	27·2	26·4
32	25·5	29·2	29·5	27·6	30·4	32·5	32·6	33·3	29·2	30·1	28·1	28·2	26·7
33	–	–	–	–	–	–	–	–	–	–	–	–	27·0
34	24·2	27·0	27·7	28·2	30·6	32·1	30·0	31·1	29·4	29·9	28·2	28·6	28·2
35	25·5	26·9	27·5	27·7	31·4	33·0	33·2	31·8	30·3	30·0	28·7	28·3	27·8
36	24·3	23·7	25·7	26·4	29·3	32·0	29·0	31·7	29·5	27·3	26·8	26·4	25·4
37	25·0	28·6	28·8	27·7	28·2	31·7	32·6	31·5	30·2	29·5	28·7	27·9	28·5
38	–	–	–	–	–	–	30·9	31·1	28·2	–	25·6	26·3	26·0
39	27·2	27·5	29·5	28·8	30·4	31·7	31·1	30·5	30·2	30·4	29·2	28·2	28·1
40	25·8	26·3	27·8	27·4	30·3	31·7	30·4	30·1	29·0	29·9	28·4	28·1	28·0
41	25·1	25·6	28·0	27·7	29·4	30·3	30·0	31·3	30·5	29·8	28·0	28·9	26·6
42	25·1	27·2	27·1	27·5	–	29·5	31·9	30·4	29·0	–	27·0	27·8	27·3
43	27·3	27·0	28·5	28·9	31·5	32·7	31·7	31·5	32·0	30·5	29·3	29·6	28·4
44	25·6	25·4	27·3	28·2	31·4	33·0	31·9	31·7	28·7	30·2	28·2	29·3	27·2
45	25·2	23·4	26·8	25·8	28·8	29·9	31·1	32·5	28·9	29·7	28·1	27·5	26·1
46	24·8	26·0	26·7	27·7	31·4	32·9	31·5	31·5	29·1	30·0	27·0	27·2	27·1
47	26·6	27·8	28·4	28·8	31·7	32·0	32·6	30·5	30·3	29·9	29·1	28·7	28·7
48	24·4	27·1	27·6	28·7	30·5	32·1	31·1	31·1	29·2	29·4	29·5	28·8	28·2
49	26·7	27·7	27·7	27·8	30·6	31·9	31·0	30·0	30·3	30·8	28·9	28·3	28·2
50	26·2	25·9	27·2	27·4	29·9	31·7	30·0	31·1	29·7	30·5	30·0	29·3	28·3
51	26·2	27·4	28·8	29·4	30·7	31·7	31·2	30·8	29·7	29·5	29·4	28·6	27·5
52	26·7	26·5	27·9	29·4	31·3	33·3	32·5	29·2	29·6	30·2	29·2	29·2	28·1
53	25·4	25·4	26·5	27·1	29·6	31·3	31·4	31·4	30·0	29·2	28·1	28·4	27·5

APPENDIX XXII. (B).

(Information supplied by the Dutch Government.) Q. 9074.

Appendix XXII.

PARTICULARS OF SAMPLES OF GENUINE DUTCH BUTTERS.

TABLES I. and II.—The Reichert-Wollny figures of Butter from Butter Factories in Groningen. Statement by Mr. T. T. Huisman, Dairy Consulting Expert at Groningen, who assisted at the Churning.

TABLE III.—Zeiss' Refractometer readings at 40° C. in the same Butter. Mr. Huisman assisted at the Churning.

TABLE I.

Date.	Factory.	R. W. Figures.
23 August 1900 - -	1	24·0
12 October ,, - -	2	24·8
13 ,, ,, - -	3	22·0
13 ,, ,, - -	4	23·7
19 ,, ,, - -	5	21·7
19 ,, ,, - -	6	21·5
26 ,, ,, - -	7	26·2
26 ,, ,, - -	8	25·5
3 November ,, - -	9	21·5
3 ,, ,, - -	10	24·6
9 ,, ,, - -	11	25·9
10 ,, ,, - -	12	26·5
16 ,, ,, - -	13	24·8
23 ,, ,, - -	14	25·4
24 ,, ,, - -	15	25·8
26 ,, ,, - -	16	22·7
1 December ,, - -	17	26·2
19 August 1901 - - -	18	24·0
19 ,, ,, - - -	19	24·35
19 ,, ,, - - -	20	24·6

TABLE II.

Factory.	1 June 1901.	1 July 1901.	1 August 1901.	24 August 1901.
1	29·8	29·3	27·0	25·45
2	28·2	27·3	24·3	24·4
3	29·0	27·9	26·45	25·7
4	—	—	25·8	25·5
5	28·9	26·8	25·7	26·4
6	27·6	29·5	25·2	25·4
7	30·3	29·3	26·7	27·1
8	29·0	27·5	24·9	25·45
9	—	—	26·2	26·8
10	29·6	27·4	25·2	26·4
11	29·3	28·7	26·6	26·7
12	30·0	31·1	27·2	26·55
13	30·1	28·2	25·45	25·7
14	29·4	27·9	24·2	25·05
15	29·9	26·7	25·15	25·7
16	28·3	27·9	24·4	25·0
17	29·3	28·6	25·3	25·7
18	—	27·0	25·1	25·0
19	—	27·1	25·5	24·4
20	—	—	24·4	24·55
21	29·9	27·5	—	24·85
22	28·4	27·4	24·7	25·0
23	28·7	27·4	26·15	26·0
24	28·4	29·3	27·85	28·0
25	30·3	29·5	26·45	25·95
26	—	27·4	25·35	26·3
27	30·3	29·0	25·6	26·3

TABLE III.

Zeiss' Refractometer readings at 40° C.

Factory.	1 June 1901.	1 July 1901.	1 August 1901.	24 August 1901.
1	44·4	44·6	45·8	45·5
2	45·1	45·8	46·6	46·4
3	45·0	45·2	45·9	46·2
4	—	—	46·1	46·0
5	45·5	46·0	46·4	46·0
6	44·4	44·5	45·7	45·6
7	44·1	44·6	45·1	45·2
8	44·7	45·1	45·9	45·8
9	—	—	45·5	45·4
10	45·6	45·5	46·0	46·3
11	45·8	45·0	45·8	45·9
12	43·6	44·2	44·8	45·2
13	44·3	44·8	45·6	45·5
14	45·1	45·9	46·4	46·4
15	45·0	45·2	—	46·3
16	45·3	45·5	46·4	46·2
17	44·8	44·8	45·9	46·2
18	—	45·6	46·2	46·4
19	—	45·9	46·2	46·5
20	—	—	46·3	46·7
21	—	45·9	—	46·2
22	44·8	45·8	46·5	46·1
23	45·7	45·8	46·2	46·2
24	45·4	45·4	45·5	45·2
25	44·7	44·7	—	45·6
26	—	46·0	46·3	46·2
27	44·7	44·8	45·8	45·3

Appendix XXIII.

APPENDIX XXIII.

DUTCH BUTTER CONTROL STATIONS.

(Note supplied by the Dutch Delegates.)

The control station of the Friesian Agricultural Society was principally considered in our evidence (Q. 9084 to 9112). Other establishments of that nature were also mentioned, and we deem it of importance that your Committee should be further enlightened on the matter.

(A.) There are in the Netherlands at the present time the following associations of butter producers (co-operative factories) which, according to their statutes have *inter alia* undertaken to oppose fraud in the butter trade, and thereby promote honest trade. These associations are:—

1. The South Netherlands Dairy Association.
2. The North Brabant Dairy Association.
3. The Association of Co-operative Dairy Factories in Friesland.
4. The Association of Co-operative Dairy Factories in Groningen.
5. The Association of Co-operative Dairy Factories in Drenthe.
6. The Association of Co-operative Dairy Factories in Zeeland.
7. The Gelderland-Overysfel Association of Co-operative Dairy Factories.

These provincial associations form one "United Netherlands Dairy Association," a federative union of associations of co-operative dairy factories, briefly known as the "F. N. Z.," established at Utrecht, which, according to its statutes, especially has in view to trace and combat fraud in the preparation of and trade in dairy produce. Although in the organisation of the dairy co-operative factories individually, and in the manner in which they are managed and controlled, fraud in those establishments is rendered all but impossible; some of the above-mentioned provincial associations have, furthermore, adopted regulations to assure the purchasers that the butter produced is genuine. Thus, in the factories of some of the associations it is provided that samples shall be taken, in order to remain fully aware of the composition of the butter at different times of the year. The factories connected with the association bear the cost of the investigation themselves. In other provincial associations a mutual sale of the produce of the allied factories is organised, in which case all the butter offered for sale is previously tested in a laboratory of their own by efficient chemists, who moreover submit to examination samples taken from the factories themselves. Such butter markets (botermijnen, as they are called) are found at Maastricht, Eindoven and Zutphen, being under the control of the provincial associations mentioned under Nos. 1, 2, and 7 respectively. The butter sent to the first two of the above mentioned butter markets is sealed and delivered subsequent to examination. To all the three markets an agent is attached, who has the charge of the purchase and despatch of the butter in the interests of foreign and other purchasers, who are not likely to be present themselves in their own interests at the sale, and yet are wishing to profit from the opportunity offered of obtaining unadulterated guaranteed pure natural butter.

The United Netherlands Dairy Association embraces at the present time 329 co-operative butter factories, whose total annual produce has been estimated at least at thirteen to fourteen million kilos of butter.

(B.) Moreover, there are in the Netherlands a large number of co-operative factories, which for different reasons are not connected with the said organisations, and therefore are beyond any mutual control. Their constitution and method of working is still of such nature that there can be no reason to doubt the genuineness of the product they supply.

(C.) The butter control station of Friesland at Leeuwarden, and the butter control station of South Holland at Leyden, which are constituted on almost a similar footing, and the particulars of which are known to your Committee, are also beyond the organisation of the co-operative associations above mentioned. It is worthy of note that 35 producers are allied to the first mentioned station, and 36 to the latter.

It may therefore be said that *four hundred and fifty butter factories* are in some way or other under control, or may be subjected thereto, producing *twenty million kilos* of butter, of which the genuineness is established, and can be proved. By far the greater part of that butter is destined for export, seeing that the home-consumption absorbs the greater part of thirty million kilos of farm butter, while the latter butter is becoming more and more disregarded for exportation. Of the estimated ten million kilos of factory butter which is not subject to any control, there is still a large portion that belongs to the production of well-constituted and, on these grounds, entirely trustworthy co-operative factories. This amount is not, however, included in the butter subject in any way to control. (See paragraph B.).

In order that the purchasers may have the opportunity of being assured of getting controlled butter, or of butter coming from one of the factories controlled in the above-described manner, trade-marks have been adopted both by the provincial dairy associations and the butter control stations, or a guarantee of the genuineness is given by some of them.

APPENDIX XXIV.

Appendix XXIV.

Handed in by Mr. E. W. T. Jones. Q. 9580.

	Sp. gr 100° F. Water 100° F.	Koettstorfer Degree.	Reichert-Wollny.	Volatile Acids as Butyric.	Soluble Acids as Butyric.	In soluble Fatty Acids.	Iodine Absorption, (per cent.	Valenta Test.	Butyro-refractometer.	Oleo-refractometer.
									Refraction Scale Degrees.	
									Zeiss.	Jean.
									At 35° C.	At 45° C.
Genuine butter	912·8	230·2	30·7	5·41	6·36	87·24	34·93	56° C.	45·5	– 28·0
Genuine butter with 20 per cent. margarine	911·4	221·8	25·5	4·49	4·95	88·74	38·28	66° C.	47·0	– 24·0
Genuine butter with 20 per cent. cocoanut oil	913·8	234·2	26·4	4·65	5·44	86·73	30·11	49° C.	44·0	– 33·0
The margarine used	905·4	194·9	2·6	0·46	0·46	94·80	54·18	105° C.	52·0	– 11·0
The cocoanut oil used	916·4	252·0	6·5	1·14	2·64	85·88	7·24	23° C.	37·5	– 51·5

Appendix XXV.

APPENDIX XXV.

Handed in by Mr. Rifle, Q. 9729.

I.—A **Table** showing Variations in the amount of Volatile Acids (Reichert-Wollny numbers) in Butter-fat from genuine Norwegian Butter, from November 1898 to December 1901.

Month.	Number of Dairies.	Number of Samples.	Reichert-Wollny Numbers.		
			Minimum.	Maximum.	Mean.
January	20	55	27·8	34·9	31·0
February	19	35	28·4	33·6	31·0
March	20	39	28·6	34·7	30·8
April	19	43	28·3	32·7	30·95
May	20	66	22·5	33·8	29·95
June	19	82	21·1	32·3	28·6
July	17	63	23·2	32·5	28·5
August	16	58	24·7	31·2	28·6
September	19	46	25·0	33·8	29·7
October	17	59	26·5	33·3	30·15
November	20	58	27·5	34·8	30·7
December	21	53	26·8	34·7	30·9

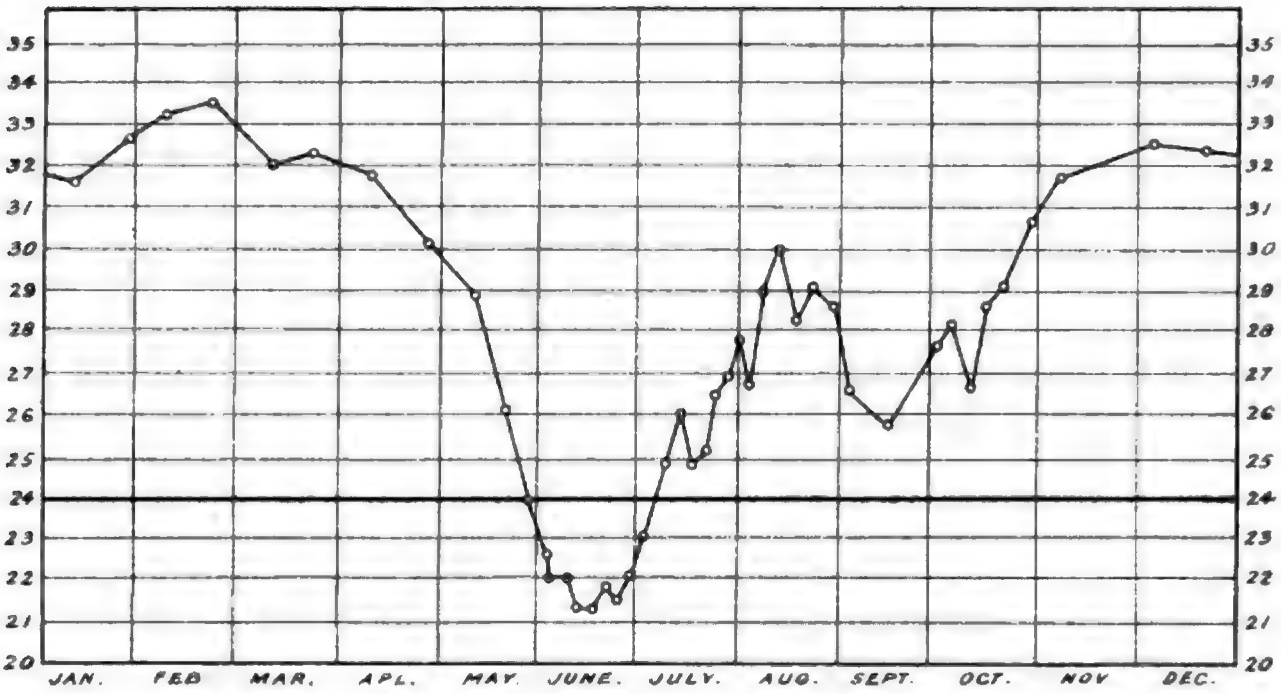
II.—A **Table** showing Variations in the Refraction (Zeiss at 45° C.) in Butter-fat from genuine Norwegian Butter, from November 1898 to December 1901.

Month.	Number of Dairies.	Number of Samples.	Refraction at 45° C.		
			Minimum.	Maximum.	Mean.
January	20	54	38·9	41·2	39·8
February	21	44	39·0	41·2	39·8
March	20	47	39·2	40·8	39·9
April	19	43	39·2	41·0	40·0
May	20	66	39·3	43·2	40·5
June	19	85	39·7	43·7	41·4
July	17	63	40·7	43·4	41·95
August	16	58	40·2	42·8	41·8
September	19	46	40·1	43·0	41·4
October	17	59	38·7	42·2	40·4
November	20	58	38·8	41·0	39·5
December	21	53	38·7	41·0	39·5

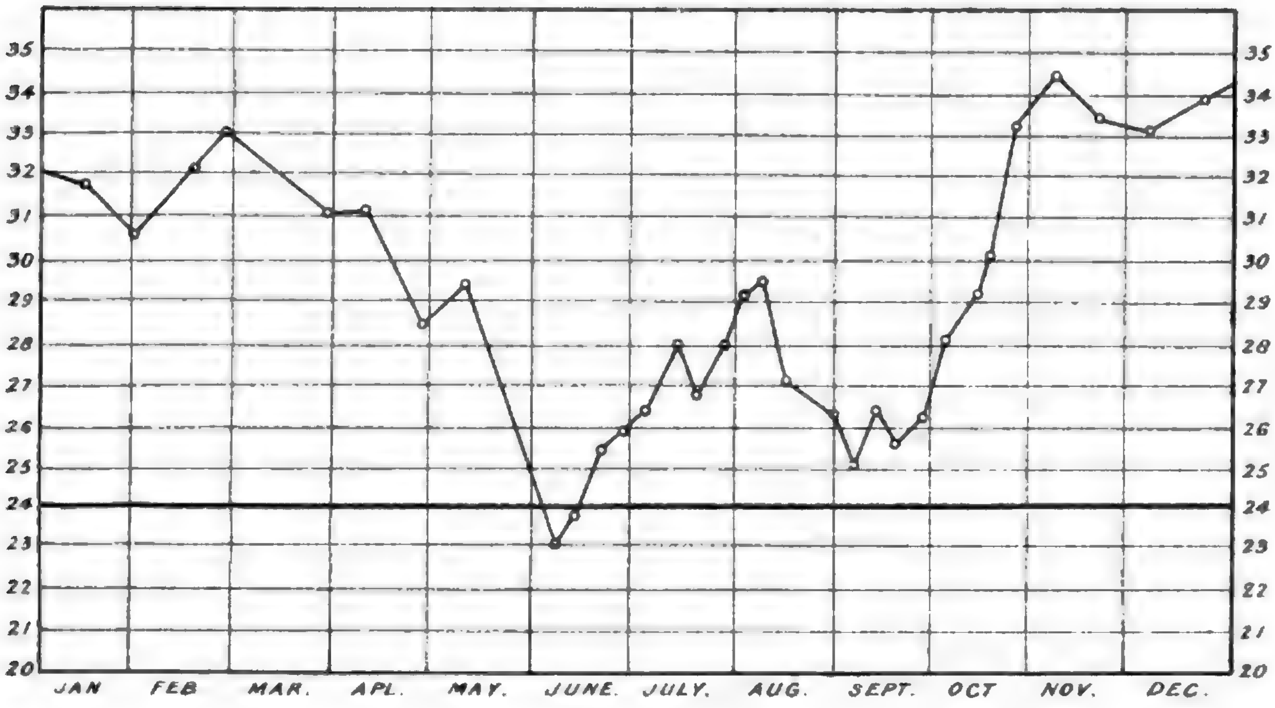
THE REICHERT-WOLLNY NUMBER

of Samples of Norwegian Butter.

BONDALENS DAIRY, 1899.



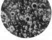
BONDALENS DAIRY, 1900.



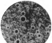
MICROSCOPIC STRUCTURE OF BUTTER.

(MAGNIFIED 300 DIAMETERS.)

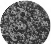
Butter which has given off brine.
(Figs. 1, 2 and 3.)



1. Percentage of Water: 13·4 %.

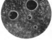


2. Percentage of Water: 15·1 %.

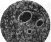


3. Percentage of Water: 10·2 %.

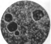
Butter which has not given off brine.
(Figs. 4, 5 and 6.)



4. Percentage of Water: 13·3 %.



5. Percentage of Water: 15·0 %.



6. Percentage of Water: 10·1 %.

APPENDIX XXVI.

Appendix XXVI.

INFORMATION SUPPLIED BY THE DANISH GOVERNMENT. Q. [illegible]

REPORT to the Danish Minister of Agriculture on the Composition of Danish Butter, Variations in same and the Cause of these Variations, based on various Reports and Communications from the Laboratory for Agricultural Research, Copenhagen; the Analyst to the Danish Government; Inspectors under the Margarine Law and others; by Harald Faber, Agricultural Commissioner to the Danish Government.

INTRODUCTION.

§1. Although Denmark was the first country to pass an Act to protect the producers and consumers of pure butter, viz., the Margarine Act of April 1st, 1885, which was very much extended by the Act of April 5th, 1888, again amended by Acts of April 1st, 1891, and March 22nd, 1897, which last Act is still in force, there are no regulations in Denmark for determining what deficiency in any of the normal constituents of butter, or what addition of extraneous matter, or proportion of water in any sample of butter, shall raise a presumption, until the contrary is proved, that the butter is not genuine. That question is in each case, as it turns up, left to the decision of the Government Analyst. The way in which he arrives at his decision, when dealing with butter produced in Denmark, will be fully explained further on.

On the other hand, a very large amount of information bearing on the subject has been collected during recent years by the Government Analyst, Professor V. Stein, working in conjunction with the inspectors appointed by the Government under the Margarine Act, and by the Laboratory for Agricultural Research attached to the Royal Veterinary and Agricultural College at Copenhagen. The Research Laboratory has carried on several special investigations on which reports have been published, among which are the works by Professor V. Storch, Director of the Chemical Laboratory, forming part of the Research Laboratory. In connection with the State butter shows,† which have been held at the laboratory since November, 1889, and for many years every fortnight, a very large number of analyses of Danish butter have been made especially with regard to the amount of water. All the reports in question accompany this present communication, but as they are printed in Danish, and are necessarily lengthy, and as the questions on which information is asked form in several cases only a small part of the reports, short extracts have been made from them and incorporated here. Most of the information collected by Professor Stein has never been published; some of it has been specially prepared for the purpose of this report.

THE NORMAL CONSTITUENTS OF BUTTER.

§2. The question of the chemical composition of butter falls naturally in two parts. In the first place butter is a mixture of butter-fat, water, curd, and a few other substances necessarily present or frequently added. Butter is a manufactured article, and the variations in its composition as a mechanical mixture of the above named constituents are largely under the control of the maker. On the other hand, the butter-fat, which forms the greater part of the butter, varies itself in chemical composition. On account of the nature of butter adulterations as generally practised, it becomes necessary to consider also the variations in the composition of the butter-fat, although the constituents of the butter-fat are not themselves immediate constituents of butter.

Considering first the normal constituents of butter, the most important is the butter-fat, and all other things being equal the nourishing value of butter is proportionate to the amount of fat.

The composition of Danish salt butter according to Storch is about as follows:—

Fat	82·7
Water	14·0
Proteids	·7
Milk-sugar	·4
Ash	·2
Salt, added	2·0

Small variations in the amounts of proteids, sugar or ash, are without importance in this connection, but variations in the amounts of salt and water affect the proportion of fat, and thereby the nourishing value.

Salt.—The amount of salt is chiefly regulated by the taste of customers. A considerable amount of butter, also Danish butter, is used without salt. On the other hand, butter exported to the Tropics in tins is heavily salted with 8 per cent., or even more, to make it keep under trying circumstances.

Other added matters are colour and preservatives.

Colour.—In Denmark only annatto, or orlean, a purely vegetable colour, is used; the use of aniline dyes is disapproved of. The colour of butter is regulated to the taste of customers, and different markets in England require different colour.

Preservatives.—The use in butter of any preservative other than salt is forbidden by Danish law (Sect. 10 of Act of 1897).

Water.—The chief constituents of butter next to the butter-fat is water. It is quite necessary that butter should contain water, dispersed through the fat in very minute drops (globules). Without these watery drops it would not be butter, nor have that peculiar texture, taste, and flavour which distinguishes it from butter-fat. On the other hand, as the nourishing value of the butter stands in reverse ratio to the amount of water present, it is desirable to protect the consumers against paying the price of butter for what must be considered an undue amount of water. This is the more necessary as it is impossible even for the most experienced people to determine whether a sample of butter contains a large amount of water or not, some samples with much water appearing quite dry, while others look quite wet—"weeping"—although having a much smaller percentage of water.

This appears from 28th Report, Laboratory for Agricultural Research, Copenhagen, 1893, page 79, where it is shown that sixteen casks of butter at the State butter shows, each weighing about 1cwt., lost averagely 1 1-3rd lbs. of water or brine, although the butter contained only a small amount of water, aver. 13·56 per cent., while sixteen other casks from the same shows with 4 per cent. more water, viz., 17·69 per cent., appeared quite dry, and lost no brine on standing for eleven days.

When butter is examined under a microscope with a sufficiently powerful lens it appears as a uniform mass interspersed with numerous minute water drops and some larger ones. Professor Storch has found that the presence of large water drops is coincident with a "weeping," waxy butter. It proves that the butter has not been worked quite enough to remove all superfluous water. Butter containing none of these large water drops appears dry, and longer working would not have reduced the amount of water. But it does not follow that a butter with superfluous water (large water drops) necessarily contains more water than a "dry" butter. On the adjoined plate are shown microphotographs by Storch of three pairs of butter samples, containing respectively 13½, 15, and 18 per cent. of water, each pair consisting of one "dry" butter without, and one "weeping" butter with these large water drops. The "weeping" butter with 13½ per cent. of water should have been worked more, when the percentage of water would have been reduced further, while the dry, opaque butter with 18 per cent. could not have had its contents of water reduced by any amount of working.

Butter with a large proportion of water present as very minute droplets, or "dry" butter with a high percentage of water, is not good butter. It is generally bitter in taste. Storch considers it due to special microbes at work during the fermentation of the cream; it is generally thought to be the result of some fault in the working. It may even be the result of a deliberate fraud, viz., working in brine or water at a raised temperature after the butter has been made, as it has been practised years ago in Hamburg and elsewhere.

Full information of the amount of water in Danish butter is given in the following chapter, which will show that Danish butter when freshly made contains averagely 14 per cent. of water, and that in most cases the water falls between 12 and 16 per cent. More than

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† Foreign Office Report, 1889. Miscellaneous Series, No. 151, deals with this subject.

Appendix XXVI.

16 per cent. of water is considered a fault, and is found to injure the quality of the butter. An excessive loss of brine by "weeping" is also considered a fault, which, however, now is very rarely met with in Danish butter.

It would be to the interest both of the producers and the consumers that a maximum limit should be fixed for the amount of water in butter.

The Amount of Water in Danish Butter.

§3. Ever since the 16th of the State butter shows, held in July, 1890, a sample of every cask exhibited has been analysed for water, and the results of these analyses have been published in the 28th and 33rd Report of the Research Laboratory and in later yearly reports. Close upon 850 dairies, private and co-operative, take part in the shows, which, therefore, are thoroughly representative of Danish butter in general. By far the greatest number of samples are from salt butter. In the 48th Report is shown as the result of special investigations that unsalted butter contains as a rule a little more water than salt butter, when otherwise made under the same conditions, but the difference is not great, about ½ per cent.

The samples of butter in question have been analysed soon after the butter was made, and would therefore show a higher percentage than if the same butters had been sampled and analysed after they had been shipped to England, distributed through the market and exposed some time in the retailer's shop. The loss of water due to evaporation alone when a cask of butter, weighing 1cwt., is left standing for 11 days in a cold room, has been ascertained to be 5ozs., averagely.

A Table showing the amount of water in about 13,000 samples of Danish butter during three different periods, 1889-92, 1892-95, and 1897-1900, has been supplied to the Committee (*see Appendix III., Interim Report*). The samples are grouped according to the amount of water, giving separately those with from 9 to 10 per cent., those with 10 to 11 per cent., and so on, and in each line is given the number of samples with that amount of water, and also the proportion that number bears to the total number for the same period. For instance, in 1889-92 286 samples had between 13 and 14 per cent. of water, and these 286 samples are 22·2 per cent. of the total number of 1,288 samples analysed in 1889-92.

Most samples have from 13 to 15 per cent. of water, very few have less than 12 per cent., and very few over 17 per cent. The average amount of water in Danish butter is 14 per cent. when sampled and analysed under the conditions described. The average for Danish butter when consumed in England would probably be nearer 12 per cent.

There has been a marked increase in the uniformity of the Danish butter with regard to the proportion of water it contains. Taking all the samples with from 12 to 16 per cent. of water it was found that they were in 1889-92 80 per cent. of the total, in 1892-95 85 per cent., but in 1897-1900 as much as 95 per cent. of all the samples fell between 12 and 16 per cent. of water. This greater uniformity attained during the last years is not due to any reduction in the number of samples with less than 12 per cent., but solely to a marked reduction in the number of samples with more than 16 per cent. During the three periods the percentage of samples of butter having above 16 per cent. of water were respectively 17·1, 9·5, and 2 per cent., and the percentages of those having above 17 per cent. of water were only 6·5, 2·9 and 0·4 per cent. of all samples.

More than 16 per cent. of water is considered a fault. It has been clearly proved by these butter shows that a higher proportion of water than 16 per cent. "injures the butter with regard both to its general and to its keeping quality." In each of the five last yearly reports from the State butter shows it is mentioned that the dairies sending butter with an average proportion of water above 16 per cent. being from two to five dairies every year, are all amongst those dairies that send butter of the lowest quality which comes to the shows. Besides, "the general public has a right to be protected from paying the price of butter for what is an undue amount of water, an excess above that which must necessarily be in the butter to make it butter." For these reasons the director for the State butter shows has in various ways tried to induce those dairies, sending either "weeping" butter or butter with a high proportion of water, to improve their make, and, as it has been shown, with a very marked result.

It has been done in two ways. When the exhibit of a particular dairy is found to contain more than 16 per cent. of water, or to give a loss of brine by "weeping" of more than 4ozs. to the cwt., as it might happen in former years, the director or owner of the dairy is communicated with, and asked to improve the make. The dairies sending in the best butter are encouraged by having their names mentioned in different classes in the yearly reports, but for each time the butter of a dairy has been found to contain too much water or to give off too much brine, it is put down one class.

The Microscopical Structure of Butter.

§4. The normal constituents of genuine butter, viz., butter-fat, water, proteids of different kinds, milk-sugar, salt, etc., build up the butter. Of these constituents the most important, the butter-fat, can be split up in component parts, the amounts of which are subject to wide variations. Before proceeding to discuss these constituents of the butter-fat, their variations and the causes of these variations, it would be advisable to consider more closely the structure of the butter itself.

Butter is produced from churning milk or cream. In milk and cream are found innumerable very minute globules of fat, perfectly round, small spheres. These in churning are made to aggregate and form the butter but they retain their spherical shape, and can be seen in the butter as individual fat-globules. When butter is melted these fat-globules cease to exist as such, they run together to form the clear butter-fat, and the butter cannot be restored to its original state or texture. This circumstance, that the fat is present in the butter as individual globules, explains to a great extent both its structure, the peculiar impression on the palate, and its great digestibility. The work of the digestive organs necessary, when dealing with other fats, of forming them into an emulsion is saved when eating butter which is a kind of concentrated fat emulsion.

When the fat-globules are adhering to form butter they necessarily leave spaces which are filled with the butter-milk in which the butter is made. The fat globules in milk are surrounded by a kind of atmosphere of a mucoid substance, which is partly retained in the butter, and fills up the interstices between the globules. These particles of buttermilk and mucoid substance are easily seen under the microscope as smaller and larger water drops. When butter is melted all these droplets float together with the curd, salt, etc., and collect under the clear butter-fat. It is to its contents of these water drops with what is in them that butter chiefly owes its peculiar taste and flavour. If fresh cream of the finest quality and taste is washed by being repeatedly stirred up in water, or better in a strong sugar solution, and again skimmed, it is possible to get the original fat-globules of the cream in an emulsion consisting only of the fat-globules in their surrounding mucoid envelopes and pure water. This cream can be churned, and butter produced which in structure and every outside appearance is exactly like ordinary butter, but which is of a peculiar flat taste, which in no way resembles the taste of butter. It is impossible to make good butter of such cream, although the butter-fat retains its original chemical composition unimpaired. This proves the important part which the microscopical droplets of buttermilk in butter bears to the taste of the butter.

The structure of butter is, therefore, peculiar in two ways. The fat is interspersed with minute droplets of buttermilk and mucoid substance (in Danish butter about half of each of these), which give the butter its taste and flavour, and the fat itself is built up of individual fat globules, which explains the facility with which butter is digested. The peculiar chemical composition of the molecule of the butter-fat renders it probably more nourishing or easier digestible for the very young, for whom the milk fat is originally intended, but the chemical composition of the butter-fat has no connection with the peculiar structure of the butter. On this structure, and on the bacteriological changes to which the milk, cream, or butter has been subjected, with or without intention, depend the taste and the flavour of butter, and they depend on them alone; they are quite independent of the chemical composition of the butter-fat. The quality of butter is almost entirely dependent on the taste and flavour. When speaking of well-made butter, where the colour, salting, etc., are uniform and adapted to the requirements of the markets, there is beside taste and flavour only one character which to some extent influences the quality of butter, viz., the texture as far as this depends on the butter-fat. The fat may be either too soft or too hard, making the butter too soft or pliable or too hard and brittle. This different character is dependent on the proportion of fluid fat or oleine in the butter-fat, as will be shown later on, but this different composition of the butter-fat is without any influence on the taste and flavour of the butter, which mainly determines the quality of the butter.

With the exception, then, of the influence which the composition of the butter-fat has on the softness or texture of butter, the quality of good butter is dependent on the taste and flavour only, and these are entirely independent of the chemical composition of the butter-fat.

RELATION BETWEEN QUALITY OF BUTTER AND CHEMICAL COMPOSITION OF BUTTER-FAT.

§5. It is a not uncommon idea amongst analytical chemists, not being dairy chemists, that the quality of butter has a relation to the chemical composition of the butter-fat contained in it, and butter with a somewhat low proportion of soluble acids (in the butter-fat) is commonly considered and spoken of as "poor butter," or "butter of low quality." There is no foundation in fact for this idea.

The reasoning that has given rise to it seems to be this: As the soluble acids are the distinguishing feature between butter and margarine from an analytical point of view, analysts who know little of the other sides of the nature of butter conclude that the more soluble acids the better the butter, because the more removed from margarine. Or the reasoning may be this: As the chemical nature of the butter flavour is similar to that of the soluble acids in the butter-fat, analysts, not being dairy chemists, conclude that it is the soluble acids in the butter-fat which give butter its flavour, while, as a matter of fact, the butter flavour is derived from outside the molecule of the butter-fat.

It is easy enough on broad lines to show the fallacy of the idea of a relation between the quality of butter and the chemical composition of the butter-fat. (1) Australian butter-fat contains more soluble acids than Danish butter-fat, but the Australian butter, on account of its lower quality, is sold in England at a lower price than Danish butter. (2) Butter-fat by itself has very little flavour, as is proved by the experiment mentioned above of tasteless butter churned from washed cream. Butter flavour is produced by the ripening of the cream, as a result of bacteriological fermentation, which in modern dairies is perfectly under control, like the fermentation of grape juice to make it into wine. The aroma of the butter depends upon the by-products of this fermentation which are present in the watery droplets, and are also partly taken up by the butter-fat without altering its chemical composition, just as fats and oils take up the scent of flowers when used in perfumeries. (3) Butter of the finest quality will deteriorate by keeping, and turn into butter of indifferent or even bad quality, and this without any appreciable change in the chemical composition of the butter-fat, which only changes as a result of much longer keeping. (4) If a sample of cream be divided into different portions, and each of these be treated by itself, it is easy enough to make different samples of butter of very different qualities, some being very fine, and others having different faults previously agreed upon, and still the butter-fat of all these samples of butter would have exactly the same chemical composition. The whole dairy science or the application of technical skill and scientific principles and methods in the dairy rests on the assumption that the quality of butter is the result of the treatment of the milk or cream (only provided these are fresh and pure), and independent of the chemical composition of the butter-fat in the cream. An attempt on the part of an analytical chemist to bring the result of his chemical analyses of butter-fat into agreement with the estimation of the quality of the butter would very soon convince him of the impossibility of finding a relation between the quality of butter and the chemical composition of the butter-fat. Analyses of samples of the mixed Normandy butters that come to London in four qualities, with a very wide range from the first to the fourth, would be specially adapted to this purpose.

§6. Positive proofs can be given in support of the statement that the quality of butter has no relation to the chemical composition of the butter-fat contained in it, and more particularly that the quality of butter is not appreciably lowered when the amount of soluble or volatile acids in the butter-fat falls low.

The amount of volatile acids in the butter-fat is measured by the Reichert Wollny figure. The quality of the butter can be measured in two ways. Either the butter can be tasted and judged by competent judges, or the price paid for it can be ascertained together with the current market prices.

By the State butter shows at Copenhagen the butter, exhibited in 1 cwt. casks, is judged independently by three groups of judges, being butter merchants and dairy experts. Each group of judges give each exhibit a character, or points, varying from 0 to 15, 0 being the very lowest quality, 15 the absolute highest. It is seldom

A TABLE of samples of Danish dairy butter showing the Reichert-Wollny figure found by analysing the butter fat, and the character of the butter given at the State butter shows:—

—	R. W.	Character.	R. W.	Character.	R. W.	Character.
	33·0	9·8	25·9	10·4	23·7	5·3
	30·1	10·6	25·8	11·4	23·7	10·1
	29·6	5·9	25·7	9·0	23·6	8·8
	29·3	8·2	25·7	3·8	23·3	4·0
	29·1	11·2	25·5	8·0	23·2	10·9
	28·7	9·1	25·3	9·0	23·1	9·7
	28·5	4·6	25·1	8·9	22·9	9·4
	28·5	10·0	25·0	9·0	22·8	9·7
	27·4	6·9	25·0	8·4	22·7	6·3
	26·8	8·7	24·8	8·2	22·5	8·9
	26·3	11·4	24·6	9·1	22·5	6·6
	26·2	9·9	24·6	6·9	22·4	8·7
			24·6	8·9	22·3	7·4
			24·5	7·8	22·2	9·4
			24·5	2·9	22·1	9·6
			24·5	8·6	22·1	9·7
			24·1	10·2	21·8	8·2
			24·1	7·3	21·5	8·7
			24·1	10·0	20·0	7·9
Average for each group	28·6	8·8	24·9	8·3	22·5	8·4

Appendix XXVI.

that any sample is judged higher than 13. The average of the awards by the three groups is the character of the butter. The higher the figure denoting the character, the higher is the quality of the butter.

Adjoined table gives a list of butter samples from the State butter shows which have been analysed. For each sample is given the R.W. figure and the character. The analyses were made for another purpose, which is the cause of the many samples of low R.W. figure. It will at once be noticed that very low characters, such as 5·9 and 4·6, are found together with high R.W. figures and that characters over the average, such as 9·4 and 9·7, are found together with very low R.W. figures, and that there is a total absence of any relation between the contents of the volatile acids in the butter-fat, as measured by the R.W. figure, and the quality of the butter as measured by the character. This is seen more plainly from the averages of the three columns where the samples are grouped by their chemical composition in three groups, those with R.W. above 26, those with R.W. between 26 and 24, and those with R.W. below 24.

—	R. W. Figure.	Character of Butter.
R. W. from 31–26	[illegible]	[illegible]
„ „ 26–24	24·9	8·3
„ „ 24–21	22·5	8·6

This table shows that the average character or quality of the butter in each group is so nearly alike that the difference is insignificant, notwithstanding the great difference in the chemical composition of the butter-fat in the different groups.

The samples in the above table can also be grouped in two groups with the same average chemical composition, and a great difference in the average quality, as under:—

—	R. W.	Character.	R. W.	Character.
	30·1	10·6	29·6	5·9
	29·1	11·1	29·3	8·2
	28·3	10·3	28·5	4·6
	25·8	11·4	25·7	3·8
	24·6	9·1	24·8	6·9
	24·5	8·6	24·5	2·9
	24·1	10·2	24·1	7·3
	23·7	10·1	23·7	5·8
	23·2	10·9	23·3	4·0
	22·8	9·7	22·7	6·3
	22·2	9·4	22·3	7·4
	22·1	9·7	21·8	8·2
Averages	25·6	10·1	25·0	5·7

The samples two and two are very similar as to the composition of their butter-fat, but different in quality and averagely the composition is the same, notwithstanding the great difference in quality as denoted by the character, 10·1 points indicating a very good quality and 5·7 a very low quality.

§7. The samples dealt with in the tables given above are collected from exhibitions of previous years, and have been analysed for other purposes. But since last April (1901) systematic investigations have been carried on in connection with the State butter shows for the purpose of finding, for the information of the Butter Regulations Committee, if it is possible to trace even the slightest connection between the chemical composition of the butter-fat and the quality of the butter. These investigations, which it is the intention to continue, have already given some results, about 100 samples having been analysed. The plan followed is this:—

(1) At each exhibition samples are taken from the butter production which obtains the highest character at the judging, and similarly from the butter of the lowest character. This is done separately for co-operative dairies and for estate dairies. This is in order to see if the very best and the very worst samples of butter exhibited show any indication of a difference in composition.

(2) At each exhibition samples are taken from the butter, which shows the highest refraction, and from that which shows the lowest refraction, separately from co-operative and from estate dairies. This is for the purpose of finding if the samples varying most in chemical composition show any indication of a difference in quality.

The results so far obtained are tabulated below, the figures being averages for fifteen shows, from April to November.

The upper part of this table shows that there is no appreciable difference in composition between the samples that were found to be of the highest commercial quality, and those of the lowest quality. In the samples from co-operative dairies there is a slight indication that the finest butter had a trifle more of volatile or soluble fatty acids, but the samples from estate dairies give an indication in the opposite direction.

The lower part of the table shows similarly that a variation in chemical composition of the butter-fat does not cause a corresponding variation in commercial quality. There is a slight indication that samples from co-operative dairies with a larger amount of volatile acids are of a better quality than those with a smaller amount of volatile acids, but among estate dairies the indication is in the opposite direction.

I. COMPOSITION OF HIGHEST AND LOWEST QUALITY SAMPLES.

	Character.	R. W.	Refraction at 45° C.
Co-operative dairies:			
Highest quality	12·4	28·8	40·9
Lowest quality	5·6	28·5	40·9
Estate dairies:			
Highest quality	10·7	27·5	41·3
Lowest quality	6·1	27·7	41·3

II. QUALITY OF HIGHEST AND LOWEST REFRACTION SAMPLES.

—	Character.	R. W.	Refraction at 45° C.
Co-operative dairies:			
Highest refraction	9·5	26·5	42·2
Lowest refraction	9·7	30·2	39·9
Estate dairies:			
Highest refraction	8·5	27·5	42·1
Lowest refraction	8·2	29·0	40·7

58. Before going to show that a low proportion of volatile acids in the butter fat does not affect the quality of the butter as measured by the price at which it is sold, attention might be drawn to the fact that high-priced butter, such as Danish butter, is to be classed amongst luxuries. When on the same day and in the same shop a pound of genuine butter can be bought at prices varying from 10d. to 16d., and when neither the chemical composition of the butter-fat nor the nourishing value show any difference, then it is evident that the extra 6d. is paid for a luxury, for the flavour, the texture, the colour, in one word, the quality of the higher-priced butter.

Information has been obtained through the Government inspectors under the Danish Margarine Law of the prices at which thirty-two consignments of butters with low Reichert-Wollny figure have been bought and resold. In the following table will be found six columns: 1, gives the date, indicated by a letter; 2, the R.W. figure; 3, the price f.o.b. in Danish port at which the butter was sold; 4, the corresponding price at which the butter could be sold to a retailer in London; 5, the top market price in London for Danish butter according to the paper, "The Grocer," and 6, the difference between 4 and 5, showing whether the butter was sold at more or less than what corresponds to the highest market price given in "The Grocer." To the price f.o.b. a Danish port must be added freight, insurance, discount, and wholesale dealers' expenses and profit, which together amount to about 9s. per cwt.; in a few instances the sales were to retailers, when no wholesaler's expenses and profits have been added.

From the last column it will be seen that the prices obtained for these butters are generally well above top prices, and the variations in prices have no relation to the variations in the R.W. figures. On one date, B, there was a loss on all the butters, but that was on account of a bad market, as reported in "The Grocer" for the week in question.

If we group the butter in the following table according to contents of soluble acids or R.W., and calculate the average value above or below the market price, we find (*see* next page):—

A TABLE showing the commercial value of some Danish butters, with low amount of soluble acids:—

Date.	R. W.	Sold at: f.o.b. Danish Port.	Corresponding Market Price. London.	Top Market Price in "Grocer."	4–5.
1.	2	3.	4.	5.	6.
		s.	s.	s.	s.
A	24·0	106	15	112	3
—	24·0	107/6	116/6	112	4/6
B	23·6	115	124	126	2
—	22·9	115	124	126	2
—	20·5	115	124	126	— 2
—	23·4	120*	123/6	126	— 2/6
—	23·0	115	124	126	— 2
—	23·0	120/3*	123/9	126	— 2/3
—	23·3	115	124	126	2
C	22·3	123/6*	127	126	1
—	23·7	119/6	128/6	126	2/6
D	22·8	104/3	113/3	110	3/3
—	23·6	103/3	112/3	110	2/3
	23·2	111/3	120/3	118	2/3
—	22·7	110/6	119/6	113	1/6
—	23·6	111/3	120/3	118	2/3
—	22·9	110/6*	119/6	118	1/6
F	22·9	110/6	119/6	118	1/
—	23·3	110/6	119/6	118	1/6
—	23·6	106/6	115/6	118	— 2/6
G	21·7	111/6	120/6	118	2/6
—	22·5	113/0	122	118	4
—	21·4	108/6	117/6	118	— 0/6
—	23·8	108/6	117/6	118	— 0/6
H	23·1	111*	114/6	114	0/6
—	23·8	107	116	114	2
I	23·5	91/6	100/6	98	2/6
J	23·5	105/6	114/6	114	0/6
K	22·6	116/3*	119/9	120	— 0/3
L	23·9	113	122	120	2
—	23·8	115/6	124/6	120	4/6
M	23·6	116*	119/6	118	1/6

* Sold to retailers.

Number Consignments.	R. W.	Value above Market Price.
		s. d.
19	23·1—24·0	1 2
13	20·5—23·0	– 6

There is a difference of 8d. in favour of the butter with a R.W. above 23·0, but the difference is very slight in a price of about 120s., and so slight that it must be considered as quite accidental, and not caused by the difference in chemical composition. This will appear more clearly when the market prices during the same weeks are given for other kinds of butter.

A TABLE giving market prices according to "Grocer" for various kinds of butter in shillings per cwt.:—

Date.	Danish.	Cork.	Canadian and States.	Russian.
A	106—112	65—87	56—98	80—90
B	122—126	69—97	58—100	90—100
C	120—126	73—100	58—100	90—100
D	108—110	60—90	50—94	80—94
E—G	116—118	60—90	56—108	86—100
H	110—114	57—91	56—100	80—92
I	96—98	68—78	70—96	80—86
J	112—114	70—80	74—102	86—96
K—L	116—120	73—95	76—104	80—94
M	116—118	70—92	74—102	80—94

The great difference in value between Danish and the other kinds of butter is not due to any difference in chemical composition. There is no reason to think that Irish or American butters have a smaller proportion of volatile acids than Danish; it is indeed much more likely that they had a larger proportion, during the respective weeks than the thirty-two samples of Danish butter with which they are compared. In other words, other factors than the chemical composition of the butter-fat influence the quality and commercial value of butter to a much greater extent. That being so it is evidently not possible to argue that the average difference of 8d. per cwt. in the value of above two groups of butter is due to the slight difference in chemical composition.

When consignments of Danish butter with a R.W. figure between 20·5 and 24·0, but produced in commercial quantities from large herds of cows and exported by the tons to England realise about 20s. per cwt. more than the butter from Ireland, Canada, or Russia, it is obviously not possible to argue that these butters are "poor" or "low" in quality simply because they are deficient in a certain constituent of the butter-fat, not being itself an immediate constituent of the butter.

However the question is approached, whether the quality of butter is ascertained by judging or by the price paid for it in the largest market in the world, the result is the same: it is not possible to prove a connection between the quality of the butter and the chemical composition of the butter-fat in the butter.

INFLUENCE OF FOOD ON THE QUALITY OF BUTTER, AND ON THE COMPOSITION OF BUTTER-FAT.

59. The question of the influence which food might have on the quality of butter is naturally of great interest to practical butter-makers, and many ideas are abroad assigning certain effects to various foodstuffs. It is outside the scope of practical dairy farming to study the effects of foods in such mixtures or in such amounts which no farmer would make use of. In the following only such feeding is dealt with which is in practical use.

So many other factors influence the quality of butter that it is very difficult to eliminate them, which would be necessary if the influence due to different feeding shall appear. Several attempts have been made, in connection with the State butter shows, to find a connection between food and quality of butter, but in vain. The influence of flavour and taste as dependent on the fermentation by microbes, either those present by natural causes or those purposely brought into the cream, is so overwhelming that it requires extraordinary care and special circumstances, not easily arranged, to eliminate it. During the years 1892-96 investigations have been carried on by the Research Laboratory on two large estates renowned for their fine butter. On each estate butter was produced separately, but under exactly similar circumstances, from three groups of 20 cows each. For a time all groups were fed alike, and it was found that the butter produced from all groups was alike in quality and composition. Then a change was gradually made in the feeding of two of the groups, and for a considerable time, two to three months, this difference between the groups was maintained. After that the feeding was again changed, so that all groups were put on the same food. If it is found that certain differences in quality of butter or in composition of butter-fat appear during the whole time of different feed, and disappear as soon as the feeding is again alike, it is concluded that these differences are due to the different feeding. (This is the principle of comparative experiments with groups of animals applied in all feeding experiments of the Research Laboratory, and these are all carried on on farms where the animals are kept under ordinary circumstances under natural working conditions.)

A very large number of judgings of butter, of chemical analyses and other research work, is involved in the experiment of which only the final results can be given here. (For full description see 37th Report Laboratory of Agricultural Research, Copenhagen, 1897.)

It was found that the change of food had an appreciable influence on the chemical composition of the butter-fat. On the other hand, the change of food, or rather the different feeding, had, with a single exception, only such influence on the quality of the butter which can be explained by the different degrees of hardness or softness of the butter-fat. In other words, it may be said that the food influences the amount of olein in the butter-fat, and thereby the texture of the butter, which again has some influence on the quality.

Four different changes of food were dealt with; only part of the food given was changed, and besides the foodstuff mentioned, the cows in all groups had equal amounts of bran, hay, roots, etc.

Four hundred and seventy cows were under observation, 1,326 analyses of milk, cream and butter were made, and 481 samples of butter were churned, and each of these were judged twice, each time independently by three judges.

1. Corn partly or totally replaced by sun-flower cake.—When corn was given without oilcake the butter was often found too hard and brittle. Replacing corn by cake made the butter more pliable, and thereby improved the quality.

Appendix XXVI.

The effect on the composition of the butter-fat was as follows:—

Food.	Iodine Absorption.	Refraction at 45° C.	Koettstorfer.	R. W.
All corn	31·4	—	232·5	30·8
Half corn, half cake	35·0	Increased.	231·3	31·3
All sunflower cake	39·4	—	227·6	30·1

The increased iodine absorption and refraction prove an increase in olein. The amount of soluble acids was not affected.

2. Corn partly replaced by rape-cake or crushed rape-seed.—The effect on quality was the same as with the sunflower cake.

The effect on composition was as follows:—

Food.	Iodine Absorption.	Refraction at 45° C.	Koettstorfer.	R. W.
Corn	29·6	38·7	229·4	29·3
Corn and rape cake	33·3	39·5	228·0	30·2

There is an increase of olein, and some increase of soluble fatty acids.

It was found that 3·6lbs. of corn and 0·4lbs. of crushed rape-seed gave the same result as 2lbs. of corn and 2lbs. of rape-cake (made from pure rape).

3. Mangolds replaced by turnips.—The butter from the turnips-fed cows was slightly inferior in quality on account of a peculiar smell. When the cream was pasteurised before butter-making, this smell disappeared, and there was no difference in quality. The turnip butter was somewhat more pliable.

The effect on composition was as follows:—

	Iodine Absorption.	Refraction at 45° C.	Koettstorfer.	R. W.
Mangolds	33·2	39·5	231·1	30·8
Turnips	35·5	40·2	228·1	29·7

There is an increase in olein, but much smaller than by the cakes. The Koettstorfer number is decreased as by the cakes. The soluble acids are decreased by the change.

4. Replacing corn by molasses (a food prepared by four parts beet-sugar molasses, three parts bran and one part palm-meal).

This change gave no change in quality, and hardly any change in composition of the butter-fat.

INFLUENCE OF PERIOD OF LACTATION, SEASON, WEATHER, ETC., ON THE COMPOSITION OF BUTTER-FAT.

§10. Already many years ago it was found, first by Professor Nilsson, Sweden, and afterwards by several others, that the composition of butter-fat alters with the condition of the cows, even a passing indisposition showing itself by a depression of the soluble or volatile fatty acids, the most notable change, however, being a quick rise in the soluble acids during the first days after calving, and a gradual decrease towards the end of the time of lactation.

This is fully confirmed by the investigations of the Research Laboratory. Averagely for 11 cows it was found that the butter-fat yielded one, two, three, four, and five months after the time of calving, and five, four, three, two, and one month before the end of lactation gave the following analytical data:—

	Iodine Absorption.	Refraction at 45° C.	R. W.
1 month after calving	36·4	40·3	31·8
2 months after calving	34·0	39·7	31·8
3 ,, ,, ,,	31·6	39·0	32·6
4 ,, ,, ,,	33·7	39·8	31·4
5 ,, ,, ,,	35·0	40·1	31·1
5 months before "dry"	36·9	40·7	28·8
4 ,, ,, ,,	37·3	40·7	27·6
3 ,, ,, ,,	38·1	41·1	26·8
2 ,, ,, ,,	38·7	41·4	22·1
1 month before "dry"	39·3	41·7	22·5

A considerable drop in the R.W. figure and corresponding rise in the iodine absorption and refraction towards the end of the period of lactation is noticeable.

Monthly averages of a large number of determinations of the iodine absorption, refraction, and the R. W. in samples of butter at the State butter shows during several years show that the iodine absorption and the refraction have their maximum, and the R. W. figure has its minimum, during the autumn. This is only what could be expected, inasmuch as more cows in Denmark are late-milking or running dry during the autumn than in any other season.

	Iodine Absorption.	Refraction at 45° C.	R. W.
January	33·3	39·5	30·9
February	34·5	39·6	31·0
March	34·1	39·8	30·9
April	33·4	40·0	30·1
May	35·0	40·1	30·0
June	37·1	40·1	30·3
July	38·4	40·6	30·2
August	39·0	41·5	28·8
September	41·6	41·6	27·3
October	44·0	41·8	27·5
November	36·6	40·0	29·6
December	33·0	39·2	30·7

§11. There are other influences which alter the composition of the butter-fat, and which generally have a much greater effect than the gradual decrease of soluble acids towards the end of lactation. Some of these have only a passing effect, as for instance, when a cow is ill, worried, chased, exposed to sudden changes of food or temperature, or similar conditions. These changes would not appreciably affect the composition of the butter-fat produced by herds in commercial quantities, and they are, therefore, passed over as of less importance. But other conditions affect the whole herd, and their effects last for weeks: they are, therefore of importance.

When cows are changed in the spring from stables to the field, or in the autumn back again to the stables, the composition of the butter-fat is changed, not as it is sometimes erroneously supposed, merely for a day or a few days, but the effect can be traced for several weeks. This is proved by the investigations of the Research Laboratory. By keeping the milk of newly-calved cows and late-milking cows separate, the effect of the change from or to stables can be traced with or without the simultaneous effect of the cows getting dry. All the figures in the following tables are averages of the analyses of the butter-fat of seven cows, and the butter-fat for each individual cow is collected from two or more successive milkings.

CHANGE FROM STABLE TO FIELD, IN SPRING. Showing composition of the butter fat before and after the change.

Cows 4 months after Calving.

	Iodine Absorption	Refraction at 45° C.	R. W.
5 weeks before change	30·2	39·0	32·3
1 week before change	30·0	39·2	31·8
1 week after change	39·3	41·4	29·3
5 weeks after change	35·6	40·5	30·4

Cows 4 months before "Dry."

	Iodine Absorption	Refraction at 45° C.	R. W.
5 weeks before change	35·2	40·6	29·6
1 week before change	34·6	40·8	28·9
1 week after change	43·9	42·7	25·6
5 weeks after change	42·1	42·7	26·6

The late-milking cows show a higher iodine absorption and refraction, and a lower R.W. figure than the fresh-calved cows, as would be expected, but in both groups the effect of letting the cows out in the fields is very marked by a rise in iodine absorption and refraction, and a fall in the R.W., and this change in the composition of the butter-fat is plainly visible five weeks after the change in the condition of the cows. The butter-fat produced when the cows come into the fields contains more olein, and the butter is therefore softer. This is well known to the practical butter-maker, who must alter his way of working accordingly

Appendix XXVI.

by churning the cream at a lower temperature. The same effect results to the practical dairy work when less corn and more oilcake is fed, as described above. The butter-fat produced in the fields contains less volatile acids, and this is the case in both groups of cows.

CHANGE FROM FIELD TO STABLE, IN AUTUMN. Showing composition of butter-fat before and after the change.

Cows 1 month after Calving.

	Iodine Absorption.	Refraction at 45° C.	R. W.
5 weeks before change	—	—	—
1 week before change	43·2	42·3	26·2
1 week after change	37·8	40·8	28·4
5 weeks after change	33·6	39·8	29·9
Cows 2 months before "Dry."			
5 weeks before change	41·6	41·9	27·0
1 week before change	44·8	42·7	24·1
1 week after change	40·8	41·8	21·8
5 weeks after change	—	—	—

The newly-calved cows show exactly the opposite change when housed in the autumn, as when put in the fields in spring, viz., iodine absorption and refraction decrease. R. W., or volatile acids increase. With the late-milking cow it is different. The iodine absorption and refraction decrease as with the newly-calved, but the R.W. decreases also. This means simply that at the end of the time of lactation the depression of the amount of volatile acids is greater than the increase which otherwise would result from turning the cows into stables.

§12. When cows are moved in the autumn from fields to stables they undergo really two different changes. Their food is changed from grass to mixed food of corn, cake, hay, straw, etc., and they come from the cold, raw weather into a warm and sheltered place. The question may, therefore, be raised with regard to the change in composition of butter-fat resulting from housing the cows: is it due to the different feeding or to the different temperature?

This point has been investigated for the Royal Agricultural Society of Denmark by Mr. B. Boggild and Professor V. Stein, and a resumé of their report, written for the purpose of this communication, accompanies this report.

Twelve cows, due to calve between three and six months from the beginning of the experiment, were selected, and divided in four groups. These were treated as follows:—First, all groups were in the field and fed on grass; then two of them, I. and II., were taken into stables where one, I., was still fed on wet and cold grass, while the other, II., had a liberal winter fodder; the two other groups were left in the field, but one of them, III., had still only grass, while to the other, IV., 5lbs. of corn and cake per head per day were given, in addition to the grass. Later on these two groups, III. and IV., were housed for a time at night only, and still later they were taken in stables day and night, and from that time the food was changed for Groups I., III., and IV., so that they, as well as II., had ordinary winter feeding. In this way it is possible to see the effect of the following treatment:—Exposure in field and feeding on grass; exposure in field, but giving a liberal feeding; sheltered in stable, but fed on cold grass; in warm stable, and fed liberally. By comparing

Groups:	I.		II.		III.		IV.	
Date.	Refraction at 45° C.	R. W.	Refraction at 45° C.	R. W.	Refraction at 45° C.	R. W.	Refraction at 45° C.	R. W.
	All the cows in the fields day and night.							
4 September	43·1	21·4	43·7	19·9	43·2	21·3	43·6	22·6
9 "	43·5	21·9	44·0	20·6	43·1	22·9	43·9	22·9
15 "	43·5	21·7	44·3	19·3	43·5	22·8	44·2	22·5
	In stables fed on cold and wet grass.		In stables fed on corn and cake, hay and roots.		In the fields day and night, grass only.		In the fields day and night, 5 lbs. corn and cake.	
22 "	43·0	22·6	41·4	24·0	43·7	22·2	44·3	20·7
29 "	42·9	23·1	40·6	24·3	43·3	20·6	44·0	20·5
	As before.				Stabled at night only, fed as before.			
6 October	43·7	22·7	40·9	23·6	43·2	20·6	43·8	20·2
13 "	43·5	21·7	40·9	24·3	43·0	20·9	43·6	20·6
	All the cows in stables day and night, fed on corn and cake, hay and roots.							
20 "	41·5	24·8	40·6	24·7	40·8	26·1	41·6	26·4
28 "	41·1	24·6	40·6	24·6	40·4	25·8	41·1	26·2

Appendix XXVI.

the analyses of the butter-fat produced under these different circumstances it will be seen from the adjoined table (1) that when cows are taken into stables in the autumn and the food is changed from grass to a liberal fodder (corn, bran, cake, hay, etc.), then there is an immediate increase in the volatile fatty acids and a reduction in refraction (olein). This appears by comparing Group II., after September 15, with Groups III. and IV.; it will be noticed that this change is fully maintained for six weeks. The same change is noticed in Group III. after October 13.

(2) That the effect on the composition of the butter-fat resulting from taking the cows into stables, when they continue to be fed on cold and wet grass, is very slight, and soon again completely lost. This appears from Group I. after September 15; it will be noticed that the butter-fat had exactly the same composition on October 13, when the cows had been in for four weeks, as on September 15, when they were yet in the field.

(3) That feeding the cows liberally while they are exposed in the field has no effect on the butter-fat. This appears by comparing Group IV. with Group III. during the four weeks from September 15 to October 13.

(4) That it did not alter the composition of the butter-fat when the cows were in warm stables at night for fourteen hours, even when they were fed liberally (Group IV., October 6 and 13); Group III. had, during the same two weeks, 2lbs. of corn and cake per head, with the same negative result.

(5) That when the cows, which had been in stables for five weeks, fed on grass, were put on liberal feeding, the character of the butter-fat changed at once (more volatile acids, less olein), see Group I., after October 13.

(6) That when the cows which for five weeks had been on liberal feeding, but exposed to the cold weather, were taken wholly into stables, the same change took place in a still larger degree, and was maintained.

The question which the experiment was meant to solve must, therefore, be answered in this way: that exposure to cold autumn weather, even for only ten hours a day, and feeding on cold and wet grass, have, separately as well as combined, the effect of depressing the volatile acids and increasing the refraction of the butter fat.

§13. In the autumn there are, therefore, several causes at work to influence the composition of the butter-fat in the same direction, viz., depressing the amount of volatile or soluble acids and increasing the refraction and iodine absorption. The cold weather and late grass and the fact of the cows being late milking or running dry, both act in the same direction, and give an increased effect. This is the reason that in the autumn the so-called "abnormal butter" is met with, butter of an unusual composition, resembling very much in chemical composition a butter mixed with margarine or other animal or vegetable fats. That most cows are late milking in the autumn is not the result of management, it is the natural thing. Cows, like other animals, are by nature destined to bear their young ones in the spring time, when fresh food is abundant and the weather is mild. In those countries where cows are mostly fed on grass from permanent pastures, and where the winter is very severe, it is by far most economical to leave this as it is, and to have the cows come in milk in the spring. Consequently they are late milking in the autumn. Even in places like Australia, not to mention Ireland, this is so much the case that the butter production in these countries is very unevenly distributed through the year. Australia has a large surplus for exportation during half the year, but a scarcity and an import, although small, during the other half. In France, although the exportation to England is remarkably regular throughout the year, the high prices in winter and very low prices in summer prove how uneven is the production. In Denmark it has for many years been successfully attempted to distribute the butter production evenly through the year, as is seen from the exportation, which in this case is a fairly good measure of the production. For the two decades, 1879-1888 and 1891-1900, the trimestrial export of butter was distributed as follows:—

	1879—88.	1891—1900.
From January to March	25 per cent.	26 per cent.
" April to June	28 "	28 "
July to September	29 "	24 "
" October to December	18 "	22 "

This has been accomplished by getting the cows to calve in many cases in the beginning of the autumn, the object being to get a large production during winter when prices are high. The large importation of Australian butter during winter has materially reduced the difference between summer and winter prices, and thereby also the inducement to produce much butter in winter, when the production is much dearer.

On account of this more even distribution of production, and the frequency of autumn calvers, abnormal butter is less frequent in Denmark than in most other countries. It is also so for another reason. The success of co-operative dairies has caused more and more private dairies to join in the movement, wherefore small productions of butter from small herds are getting rarer. The large makes from milk of many herds are naturally more uniform also in chemical composition. Something has also been done to avoid the abnormal butter by advising farmers to take their cows into stables earlier in the autumn. At the same time it must not be supposed that abnormal butter has ceased to exist in Denmark; it occurs every year, as will be shown below, and there is no reason to suppose that it will ever disappear.

It is generally characteristic for abnormal butter to have, besides a low R.W. figure, a high refraction. All four groups, of three cows each, dealt with in the last table, gave during the three first weeks of September a R.W. between 19·3 and 22·9, together with a refraction (at 45° C.) between 43·1 and 44·3. But it is not necessarily so. A refraction of 40·6—40·9 is found together with a R.W. of 23·6—24·3 in Group II.; a quite normal refraction may, therefore, be found together with a low R.W. That comparatively few instances of this occurrence are noticed is a natural consequence of the way in which butter samples are dealt with in some laboratories when they come to be analysed. It is usual, when many samples are to be examined, to determine first the refraction, and to use this as a "sorting test." When the refraction is below a certain limit the samples are passed as undoubtedly genuine, and only those with a higher refraction are analysed further. It is obvious that in this way samples with a low refraction and a R.W. so low that it might well give cause of suspicion, may very often escape notice.

DANISH BUTTER, WITH A REICHERT-WOLLNY FIGURE BELOW 25 c.c.

§14. The inspectors appointed by the Danish Government under the Margarine Act have free access to any place where butter or margarine is manufactured, stored or sold. They take a large number of samples of butter from dealers, makers, importers, and exporters for analysis, the analyses being made in the laboratory of Professor Stein, Copenhagen. During the last years the inspectors have themselves sorted the samples of butter by means of the refractometer test (Zeiss, at 45°C.), and only those samples which gave over a certain refraction were sent in for analysis. A large amount of information is obtained by these analyses. For the purpose of this communication a compilation has been made of the analyses of all samples of Danish butter met with during the five years, 1896-1900, showing a R.W. below 25 c.c. A complete list of the 449 analyses accompanies this report.

The following tests have been made in nearly all these 449 cases: R.W., refraction at 45°C.; specific gravity at 100°C., taking water at 15°C. as unit; Koettstorfer number and saponification equivalent; iodine absorption; tests for cotton oil and sesame oil.

When these analyses are grouped according to the R.W. figure, counting in one group all samples below 20, in the next all between 20 and 21, and so on, we find:—

R. W. figure.	Number of Samples.
From 18·4—19·9	6
" 20·0—20·9	10
" 21·0—21·9	33
" 22·0—22·9	58
" 23·0—23·9	135
" 24·0—24·9	207
TOTAL	449

Appendix XXVI.

This Table shows that a not inconsiderable number of Danish butter samples fall below R.W. 25. The proof that these samples are all genuine will be shown below. More than one half of the samples are even below R.W. 24. About one quarter of them are below R.W. 23.

On account of the way in which these analyses are compiled it is not possible to state quite exactly what proportion they bear to the total number of samples of Danish butter taken under the Act during the five years, but it is estimated that about 2 per cent. of these samples are represented by the 449 analyses. If that be so, then 2 per cent. of Danish butter falls below R.W. 25, 1 per cent. falls below 24, and ½ per cent. falls below 23. As such abnormally low figures, however, are met with only in the autumn, the proportion of abnormal butters during autumn would be very much greater.

There is a certain relation between the different tests; when the amount of volatile acids (R.W.) increases, the specific gravity and the Koettstorfer number increase also, while the refraction and the iodine absorption decrease. This, however, is only true in a very general way, and when speaking about fairly great variations. It is more certain that the sp. gr. and Koettstorfer number increase or fall with the R.W. figure than that the iodine absorption and refraction move in the opposite direction of the three first-named tests. On the other hand, the iodine absorption and refraction generally vary in the same direction. This is only what could be expected. It is the amount of volatile or soluble acids which chiefly causes the variation in the sp. gr. and Koettstorfer, while it is the amount of oleic acid that influences the iodine absorption and refraction. It has already been shown that while generally a low amount of volatile acids is found together with a high refraction, there are distinct exceptions from this rule, among undoubtedly genuine butter. Different samples of butter with the same proportion of volatile acids may show great variations in refraction (oleic acid), and likewise butters with the same refraction may vary considerably in regard to their contents of volatile acids.

If we compare the tests more minutely for smaller variations, a still greater absence of relation between them will appear. The 449 analyses have been grouped according to the R.W. figure, taking together all analyses the R.W. of which fall within the same ½ c.c., and giving for each group the variations for each of the other tests. (See table above.) There is a very slight indication that sp. gr. and Koettstorfer increase with the R.W., but it will at the same time be noticed that in the last group, with a R.W. from 24·5-24·9, both sp. gr. and Koettstorfer show figures below—some in the first group, with a R.W. 18·4-19·9. For refraction and iodine absorption it is not possible to trace any consistent variation in relation to the other tests, except perhaps in the left-hand column in the figures for iodine absorption.

R. W.	Sp. Gr.	Koettstorfer	Refraction at 45° C.	Iodine Absorption.
18·4—19·9	862·8—864·1	21·52—21·79	42·4—43·8	42·5—47·2
20·0—20·9	863·6—864·6	21·54—21·98	43·0—44·1	42·6—49·4
21·0—21·4	863·5—864·7	21·67—22·22	41·0—44·1	42·3—48·3
21·5—21·9	863·6—864·6	21·54—21·95	42·8—44·3	42·5—49·1
22·0—22·4	863·7—864·9	21·66—22·06	42·6—44·4	40·9—47·6
22·5—22·9	863·6—865·2	21·58—22·09	42·3—44·5	42·0—49·7
23·0—23·4	863·7—865·1	21·64—22·25	42·0—44·8	39·6—49·2
23·5—23·9	863·6—865·1	21·62—22·39	42·1—44·6	39·5—49·1
24·0—24·4	863·7—865·3	21·71—22·49	41·3—44·6	38·6—49·8
24·5—24·9	863·1—865·7	21·76—22·47	42·0—44·0	40·2—47·3

§15. This want of relation between the different chemical tests when applied to butter, makes it all the more difficult from the chemical analysis alone to draw any definite conclusion as to the purity or otherwise of a sample of unknown origin. The guarantee for the genuine nature of the samples of Danish butter, of which the analyses are given here, is therefore not to be sought in the analyses. It is, indeed, the guarantee of purity, otherwise obtained, that enables the analyst to affirm that analyses such as those given are compatible with the butter being genuine. This is more fully shown in the table on next page; it explains how the analyst to the Danish Government proceeds when suspicious samples of Danish butter are met with.

If a sample of butter sent him for analysis from one of the inspectors under the Margarine Law shows a composition which gives rise to suspicion, the matter is fully investigated. Most often the sample would be derived from a merchant's warehouse. The inspector is instructed to draw further samples from the same dairy's butter, of which the next week's make would already have been received by the merchant by the time the first analysis is completed. The inspector then proceeds to the dairy, makes a full inspection of premises to see if any material for adulteration should be present, draws samples of the butter already made, watches the arrival of the milk, and sees this passed through the separator, during which process he draws an average sample of the cream. The samples of butter and cream are sealed and sent to the laboratory. If it is then found that the composition of the butter-fat from the cream corresponds to the composition of the fat from the butter taken at the same time and during the previous week from the same dairy, then conclusions are drawn from the purity of the fat in the cream to the purity of the butter, which gave rise to the suspicion.

The table gives several instances from recent years of such suspicious, or, more correctly, abnormal butters, proved to be genuine by the chain of evidence explained. It will be noticed that most cases have a low R.W. and a high refraction and iodine absorption, but the last example but one shows the previously mentioned combination of low R.W. with low or normal refraction, which in this case, as in the investigation by Messrs. Boggild and Stein, is caused by the cows being taken into stables. The butter from the same dairy sampled the previous weeks at the merchant's warehouse was produced while the cows were yet in the fields. Hence the difference in the refraction.

Appendix XXVI.

A TABLE of analyses of butter and cream from Danish dairies illustrating the control of butter-making under the Margarine Law.

Reichert-Wollny Number.	Soluble Acids Calculated from R. W.	Refraction at 45° C.	Specific Gravity at 100° C., Water at 15°C.	Koettstorfer Number.	Saponification Equivalent.	Iodine Absorption.	Nature of Sample.	The Sample was taken	Remarks.
20·1	3·93	44·0	—	—	—	—	Butter	At merchant's warehouse.	
21·0	4·11	43·8	—	—	—	—	Ditto	In the dairy.	
20·2	3·96	[illegible]	—	—	—	—	Ditto	Ditto.	
19·7	3·85	43·8	—	—	—	—	Cream	Ditto.	
[illegible]	3·90	44·2	—	—	—	—	Ditto	Ditto.	
18·4	3·60	43·4	0·8628	21·62	260·7	[illegible]	Butter	At merchant's warehouse.	
18·5	3·62	43·6	—	—	—	—	Ditto	Ditto.	
18·4	3·60	43·8	—	—	—	—	Ditto	Ditto.	
19·8	3·88	43·1	—	—	—	—	Ditto	In the dairy.	
19·3	3·77	43·4	—	—	—	—	Cream	Ditto.	
18·6	3·64	[illegible]	—	—	—	—	Ditto	Ditto.	
20·4	3·99	43·1	—	—	—	—	Butter	At merchant's warehouse.	
21·7	4·24	43·6	0·8639	21·88	256·4	46·1	Ditto	Ditto.	
22·5	4·40	43·8	—	—	—	—	Ditto	In the dairy.	
22·6	4·42	43·6	—	—	—	—	Cream	Ditto.	
20·4	3·99	43·1	—	—	—	—	Butter	At merchant's warehouse.	
22·8	4·46	[illegible]	0·8639	22·05	254·4	[illegible]	Ditto	Ditto.	
22·6	4·42	43·0	—	—	—	—	Ditto	In the dairy.	
23·0	4·50	43·0	—	—	—	—	Cream	Ditto.	
22·4	4·41	43·2	0·8639	21·96	255·5	44·6	Butter	At merchant's warehouse.	
21·7	4·24	43·6	—	—	—	—	Ditto	In the dairy	Herd of 100—150 cows.
22·2	4·34	43·5	—	—	—	—	Ditto	Ditto.	
22·0	4·30	44·0	0·8648	21·97	255·4	49·3	Cream	Ditto.	
21·5	4·20	43·9	0·8641	21·80	257·4	48·7	Butter	At merchant's warehouse.	
22·8	4·46	43·2	—	—	—	—	Ditto	In the dairy.	
22·8	4·46	43·6	—	—	—	—	Ditto	Ditto.	
24·0	4·70	[illegible]	0·8649	22·16	253·1	46·4	Cream	Ditto.	
24·4	4·77	42·8	[illegible]	21·91	256·1	43·4	Butter	In the dairy.	
25·7	5·02	42·3	—	—	—	—	Ditto	Ditto.	
26·0	5·06	42·2	—	—	—	—	Cream	Ditto.	
19·8	3·88	43·1	0·8632	21·74	258·0	42·5	Butter	In the dairy	45 milch-cows.
20·0	3·98	43·0	—	—	—	—	Ditto	Ditto.	
20·4	3·99	[illegible]	—	—	—	—	Cream	Ditto.	
21·3	4·14	[illegible]	0·8642	21·70	258·5	44·9	Butter	At merchant's warehouse.	
19·6	3·83	42·4	0·8632	21·68	256·8	43·0	Ditto	Ditto.	
21·3	4·14	41·0	—	—	—	—	Ditto	In the dairy	About 40 milch-cows.
21·3	4·14	41·1	0·8639	22·16	253·2	34·6	Cream	Ditto.	
24·6	4·81	43·2	0·8642	21·93	255·8	45·0	Butter	At merchant's warehouse.	
24·0	4·70	43·3	0·8647	21·97	255·7	45·2	Ditto	Ditto.	
23·3	4·56	43·4	—	—	—	—	Ditto	In the dairy.	
23·6	4·61	43·3	0·8645	21·89	256·3	45·2	Cream	Ditto.	

VOLATILE OR SOLUBLE ACIDS.

§16. The determination of the fatty acids peculiar to butter-fat, as compared with most other fats, is a very important part of the analysis of butter for the purpose of determining its purity. These acids are four in number, viz., butyric, caproic, caprylic, and capric acid. They are all volatile, and pass over with the water when a solution containing them in their free state is subjected to distillation, as in the Reichert process. The two first are found in butter-fat to the amount of several per cent., butyric acid ranging from 3 to 5, caproic acid from 1½ to 3 per cent.; they are soluble in water.

Caprylic acid is found only in small quantities; it is hardly soluble in water. Of capric acid mere traces only are present; this acid is insoluble in water. These two acids, according to Duclaux, amount together to less than 2 per cent. of the total amount of the volatile acids. Consequently there is very little difference in the total amount of the soluble and of the volatile fatty acids in butter-fat; there might, for instance, be 6·0 per cent. of soluble acids and 6·1 per cent. of volatile acids. It is certain that different analysts, determining the amount of soluble acids in butter-fat, would not, as a rule, agree so well that the difference in their results would be less than 2 per cent. of the soluble acids. An analytical determination of the soluble and of the volatile fatty acids will, therefore, practically give the same result, and, when speaking of the percentage present in butter-fat, volatile and soluble acids may be used as synonyms.

Dupré first suggested the improvement of the original Hehner-Angell method, by which the amount of soluble acids were determined in the filtrate from the insoluble fatty acids. The determination is not very exact; it takes a long time, and the results obtained by different workers are not always agreeing. It is absolutely necessary, if this method shall give concordant results in the hands of different analysts, that very distinct and minute regulations for all the different manipulations be agreed upon, such as the way of washing, amount of wash water, etc. It is very significant that such uniform rules have not been adopted.

The method of determining the volatile fatty acids, first introduced by Reichert, has superseded the Dupré method in most laboratories. The extensive use made of this method soon made it desirable to guarantee uniform results by working exactly alike in all details, and when Wollny had greatly improved the method, and proposed definite regulations as to procedure, time, shape, and size of vessels, etc., these were adopted universally, with the result that the Reichert-Wollny figures, determined by different analysts on different parts of the same butter sample, agree exceedingly well if the work is done at all carefully.

One analyst can attend to four determinations of soluble acids at the same time and to the same number of R.W. figures, but in the same time in which four determinations of soluble acids are made 24 R.W. determinations can be finished. This, together with the greater concordance when working by the R.W. process, sufficiently explains why this latter is so universally preferred.

In distilling of the volatile acids in the R.W. process only a part of the solution is distilled over, but always the same part, viz., 110 c.c. of 140 c.c. Now Duclaux has shown that, for each of the volatile acids in question, the acids distil over quicker than water, that the progress of the distillation is always the same for the same acid, but different for the different acids, and that when several of them are distilled together, each of them behaves as if it were alone. If butyric acid alone were present, the same proportion of the butyric acid in the solution would always be distilled off when 110 c.c. are distilled from 140 c.c.; the same applies to caproic acid. But the caproic acid would pass over in a greater proportion than the butyric. When, for instance, 10 per cent. of a solution of the two acids are distilled off, then 15½ per cent. of the butyric acid and 30 per cent. of the caproic acid are distilled off. If the two acids were always present in the same proportion, the same proportion of them would always pass over in the R.W. process. As this is not the case, there is a slight variation in the proportion which passes over. When measured by the total quantity of soluble acids, by the Dupré method, it is found that generally from 88 to 92 per cent. of the total soluble acids are distilled over by the R.W. process. This variation is certainly within the likely limit of error in determining the soluble acids. The R.W. method may, therefore, claim to give fully as reliable results as the old method of estimating the soluble acids, to give these results in a much shorter time, and in a way that all careful workers may get concordant results. For this reason this method has almost universally superseded the old method.

The total quantity of volatile or soluble acids can easily be calculated by the R.W. figure, taking 90 per cent. to have distilled over. For the purpose of calculation it is agreed to consider the acids to be butyric acid only, but this applies to the Dupré and R.W. methods alike. A determination of the soluble and insoluble acids, such as were used before the R.W. process was introduced, gives no additional information, except that it may show how exactly the analyst has been working—and is therefore very seldom used.

LIMITS FOR THE CONSTITUENTS OF THE BUTTER-FAT.

§17. As mentioned before, the constituents of the butter-fat are not themselves constituents of the butter. It is of importance to the consuming public that butter should contain a certain proportion of butter-fat, and in Germany a legal minimum of fat in butter has been fixed by public regulation, viz., 80 per cent., but it is of no interest to the public whether the butter-fat contains more or less of the different constituent parts, among which the fatty acids. The quality of the butter, which is of importance, is quite independent of the proportion of volatile acids in the fat, and more dependent of the proportion of oleic acid which may cause it to be too hard or too soft.

When it is proposed to lay down limits for the amount of the constituents of the butter-fat it is therefore simply in order to help analysts over the difficulty under which they labour at present when they have to decide whether a butter is genuine or not. As the analyst to the Danish Government, by means of the machinery provided by the Margarine Law, is in the position to trace all samples of Danish butter back to their source, and to have this source closely investigated, he has no need of limits, and no regulations fixing such limits have therefore been issued in Denmark. If it were possible to distinguish genuine from adulterated butter by some infallible test which could be applied in all cases, no limits would be wanted. It has lately been claimed that the microscopical examination of butter with the aid of polarised light yielded such an infallible test, but extremely useful as the test certainly is, it is not infallible, and the claimant of its infallibility did inconsistently advocate limits.

Producers of genuine butter are more than any other class interested in preventing the sale of adulterated butter as genuine. The fixing of limits, which more or less directly will mean a minimum for the contents of soluble or volatile acids, is very difficult, because if fixed too high the limits would tend to exclude genuine butter, which might even be butter of high quality, and if fixed too low would tend to encourage the scientific mixing on a large scale of butter with adulterants that could at present not be easily detected.

As Danish is probably more uniform than most other kinds of butter, and more rarely "abnormal" than several other imported butters, and as it might be easier to prove the purity of a sample of Danish butter which might be found to fall below the limit, if such be fixed, than would be the case with most other imported butter, Denmark needs fear the result of a high limit less than several other countries as far as the butter producers are concerned. Danish trade, however, is very much interested in butter from other countries, as Sweden, Finland, Russia, and especially during the last years, Siberia; in the last named countries abnormal butter are frequently met with.

It is to be hoped that the only just and rational way out of the difficulty will yet be found when somebody shall succeed in discovering a test or tests, or a combination of different tests by means of which adulterated butter can be distinguished from genuine but abnormal butter.

London, November, 1901. (Signed) HARALD FABER.

Appendix XXVII.

APPENDIX XXVII.

Handed in by Mr. HARALD FABER, Q. 9924.

Result of the analysis of 26 samples of Russian Butter, which by the Reichert-Wollny test showed less than 25 c.c., and which were sent in by the Inspector of the 1st District of Control, amongst a total of 108 samples of Russian Butter.

Reichert-Wollny number.	Specific gravity at 200° C. Water at 15° C.	Koettstorfer number.	Iodine Absorption.	Refraction at 45° C.	Vegetable Oils.
21·4	0·8630	21·74	41·7	43·0	None.
21·8	0·8642	21·66	44·8	43·5	–
22·0	0·8640	21·73	44·2	43·3	–
22·5	0·8642	22·09	44·0	43·4	
22·5	0·8647	22·10	32·8	40·5	–
23·1	0·8643	21·68	43·9	43·6	–
23·1	0·8639	21·76	42·3	43·3	–
23·6	0·8640	21·78	42·5	42·8	–
23·7	0·8640	21·88	41·3	42·0	–
23·8	0·8650	22·18	38·9	41·8	–
24·0	0·8642	21·67	42·8	42·9	–
24·0	0·8639	21·92	35·4	41·1	–
24·0	0·8641	21·84	43·9	42·8	–
24·1	0·8645	21·87	43·3	43·2	–
24·1	0·8644	21·87	42·7	43·4	–
24·1	0·8639	22·05	40·8	42·0	–
24·2	0·8641	21·93	44·2	42·8	–
24·2	0·8642	21·99	33·1	40·9	–
24·3	0·8645	22·26	38·4	41·9	–
24·4	0·8646	22·23	36·2	40·0	–
24·4	0·8643	21·78	42·9	43·1	–
24·6	0·8643	21·98	41·2	43·1	–
24·7	0·8642	22·09	43·4	42·9	
24·7	0·8643	21·95	41·6	42·5	–
24·7	0·8643	21·95	41·8	43·2	–
24·8	0·8646	21·81	41·3	42·9	–

(Signed) V. STEIN.

Appendix XXVIII.

APPENDIX XXVIII.

Handed in by Mr. HARALD FABER, Q. 9946.

THE CONTROL OF DANISH BUTTER.

The following number of samples of butter and margarine were analysed under the Danish Margarine Law during the last five years, the year ending the 31st of March:—

	Butter.	Margarine.
1896-1897	6·367	78
1897-1898	6·337	225
1898-1899	6·379	192
1899-1900	5·462	263
1900-1901	5·329	589

Number of samples of butter for export included in above numbers:—

	Tested by inspectors.	Analysed.
1896-1897	5,866	730
1897-1898	5,299	802
1898-1899	5,696	327
1899-1900	4,736	81
1900-1901	4,037	159

In addition to these samples, duplicates of the samples drawn by H.M. Customs in British ports are forwarded by me to Copenhagen, and analysed by Professor Stein, and for each sample of Danish butter involved a further sample of the following week's butter from same dairy is drawn by the inspector and analysed.

The following number of duplicate samples of Customs' samples have been sent by me to Copenhagen:

	Samples.
1897	80
1898	91
1899	96
1900	164
1901	249

During the year 1901 249 samples were taken by the Customs from butter imported into the United Kingdom from Danish ports.

Of these 249 samples 107 were from butter of other nationality than Danish.

Thirty-one samples were described as Swedish or came from shippers in Swedish ports in transit.

Fifty-nine samples were described as Russian or came from shippers in Russian ports in transit.

One sample came from Germany (Schleswig) in transit.

Sixteen samples were not fully described.

The 142 samples were from Danish dairies, and in each case an analysis was made both of the sample sent by me and of another sample drawn from the butter from the same dairy made the week following that when the butter sampled by the British Customs was manufactured.

Not one of all these samples has been found to be adulterated, nor has boric preservative been found in any sample of Danish butter. Boric preservative was found in one sample of butter imported into Denmark in each of the two last years, 1899-1900 and 1900-1901. No boric preservative was found in any of the duplicates of British Customs' samples for the year ended 31st March, 1901, nor during the remainder of the year 1901.

Appendix XXIX.

APPENDIX XXIX.

REPORT ON AN INQUIRY INTO THE COMPOSITION OF BRITISH BUTTER, BY PROFESSOR T. E. THORPE, C.B., LL.D., F.R.S.

REPORT on the results of the Analyses, made in the Government Laboratory, of samples of Butter collected at various places in the United Kingdom during the year 1901-1902.

The following inquiry into the composition of butter produced in the British Isles was undertaken in the Government Laboratory, with the concurrence of the Board of Agriculture, with the object of placing the results before the Departmental Committee on Butter.

In order to make the inquiry as complete as possible, the following scheme for the sampling of butters, and for procuring the necessary information as to the conditions under which the cows were living at the time the sample was produced, their periods of lactation, etc., was drawn up.

(1) Not more than 10 per cent. of the butter should be obtained from the milk of single cows or of small groups of cows. The remainder should be obtained from the mixed milk of large, or, at least, moderately-sized herds.

(2) Samples should be obtained from England, Scotland, and Ireland, comprising at least 20 different areas spread over the three countries as may be found most convenient.

(3) The samples should be fairly representative of farmers' creamery and factory, or blended, butters, and details as to the method of handling the butter might also be usefully supplied.

(4) Wherever practicable the lactation periods of the cows should be given at the time the sample was produced.

(5) Some provision might be made to secure samples within a fortnight of the cows being turned out from shelter, and again about a week after beginning to feed in the open.

(6) Information is desirable as to food of the herds, whether normal for the season and locality or special or experimental.

(7) As nearly as possible a uniform method of sampling should be followed, and might comprise the following points :—

The quantity of butter should not be less than half a pound, formed of one piece only, and not wrapped in paper, but by preference placed in an earthenware jar, with little or no pressure, so as to allow the original amount of water present to be, as far as practicable, correctly estimated. The mouth of the jar should be closed with an earthenware or celluloid lid.

In the method of sampling finally adopted the samples were placed in large wide-mouthed glass bottles, closed with a metal screw-cap, caused to fit the mouth tightly by means of a layer of cork.

To ensure that all the information regarding each sample should be obtained in a uniform manner, it was decided to send to producers, etc., who were willing to supply samples, printed forms, stating all the information we desired ; one of these, filled in, to be forwarded to us with each sample. We were able to secure samples from fourteen sources in England, one in Wales, and fifteen in Scotland. These sources included farms, dairy institutes, and creameries, and were so arranged as to cover as wide an area as possible. In England and Wales, eight Dairy Schools and Agricultural Colleges, and six farms and creameries, and in Scotland one Agricultural College, one creamery, and twelve farms undertook to supply samples. From the majority of these sources samples were received nearly every month for a period of twelve months, beginning in May, 1901.

With regard to Ireland, the sampling was placed under the control of the Department of Agriculture for that country. At the commencement, owing to some misunderstanding as to the objects of the inquiry, samples were received which had been taken in a somewhat promiscuous fashion. No particulars were sent, nor were consecutive samples taken from the same farm. However, later on this confusion was removed, and from September, 1901, to May, 1902, samples were received from 12 sources regularly, as in the case of England, Scotland, and Wales. These sources included two Dairy Schools and 10 creameries.

By arranging that the samples should come from places covering as wide an area as possible, we endeavoured to obtain results showing how butters produced from the milk of cows fed upon the hill pasturage in the North of Scotland compare with those from cows fed upon the more succulent grass of the southern districts, and by comparing the results obtained on analysing these samples from the North of Scotland with those obtained from samples from Norway and Sweden, we hoped to be able to throw some light on the causes of the abnormalities which occur very frequently in butters coming from these countries.

Again, by comparing the results obtained from the examination of butters produced from a herd of cows in one part of the country with those obtained from a nearly similar herd in another part of the country, it was hoped that we should be able to point out the effect of "climate." Further, we hoped to be able to draw some definite conclusions from our data as to the influence of lactation period on the composition of butter, and in fact, that we should reach some conclusions with regard to the many factors which are known, or are supposed, to have some influence on the composition of butter fat.

The samples on being received at the laboratory were examined, as soon as possible, for the proportions of water, curd and salt. They were then melted, and in order to obtain the butter fat free from water, curd and salt, etc., the melted fat was filtered. The clear fat was then put into bottles provided with close-fitting caps, and placed in the cold room until the further examination could be undertaken. This further examination included the following determinations :—(1) The specific gravity at 100° F. (2) The Zeiss reading at 45° C. (3) Test for the presence of cotton-seed oil. (4) Reichert-Wollny figure. (5) The proportion of soluble acids. (6) The proportion of insoluble acids. (7) The mean molecular weight of the insoluble acids ; and (8) the Koettstörfer value.

The above data, with one or two exceptions, were obtained for 357 samples of butter during the course of the inquiry. In addition to these samples, some additional 80 were specially examined for the water, curd and salt at various times, at the request of the Department of Agriculture for Ireland.

The various figures, thus obtained, have been prepared in tabular form, and are appended. From the figures curves, showing the variations met with month by month in the butters from each separate farm or other source, have been constructed, and are also appended.

From these data I draw the following general conclusions. First, with regard to the influence of the nature of the food. Cows fed on grass alone, it appears, give butter fat having a higher Zeiss figure, and a higher Koettstörfer number for the same specific gravity, and Reichert-Wollny figure, or in other words, containing a larger proportion of olein, than do cows receiving a mixed diet, consisting of the various "special fodders." During the period in which the autumn grass forms the main food of the cows, it is noticed that the Reichert-Wollny figure, the soluble fatty acids and the specific gravity of the butter fat tend to decrease, while the Koettstörfer number, the Zeiss figure, and the insoluble acids tend to increase. Only in this case is it possible to point out the effect of any one kind of food upon the composition of the fat, since in the majority of cases the cows received a very mixed diet.

Cereals, clover, turnips, mangolds, legumens, and the various oil cakes, all seem to form highly suitable ingredients of a mixed fodder. If the cattle are giving fat showing normally good figures, the addition of the various oil cakes, etc., to their food has little or no effect. There is no doubt that a mixed diet, such as the above, leads to a high specific gravity, a high Reichert-Wollny figure, and a high proportion of soluble acids, accompanied by correspondingly low figures for the Zeiss and Koettstörfer numbers and a low proportion of insoluble acids, provided the cows are sheltered from inclement weather. But if the cows are left in the open during unsettled weather, addition of these various special fodders to their food seems to be without any effect upon the chemical characteristics of

Appendix XXIX.

the fat, even though this is below its normal composition at the time.

In almost every case, we notice a material decrease in the Reichert-Wollny figure, in the amount of soluble acids and in the specific gravity, accompanied by a material increase in the amount of insoluble acids, the Zeiss figure, and the Koettstörfer number, during the summer months. This would appear to be due, to some extent, to a deterioration in the quality of the grass; but, judging from the results of the analyses of butter from Kilmarnock, the Colonial College, Hollesley Bay, and one or two other farms, etc., it is quite possible to keep the figures uniform during the whole of the summer by feeding the cows on grass alone.

Turning to the question of the breed of the cows, the figures arrived at during this inquiry point to the fact that all breeds of cows used at the farms, etc., from which butter was derived are capable of producing fat of equally good composition.

From a consideration of our figures, with a view to discovery of the relation between the climate and the composition of butter fat, it is seen that butters coming from parts of our islands where considerable climatic variations are experienced show greater variations in their composition than do butters coming from those portions of the country where the climate is more equable. But, though the figures obtained for the butters coming from the Scotch farms show wider variations than for those from the English farms, taken month for month, the butters from Scotland compare very favourably with those supplied by the farms, etc., in England and Ireland. The greater number of the Scotch farms, from which samples were received, are situate in the extreme north, and in the winter and early spring they give figures equal with, if not better than, those from the more southern farms. This seems to point to the fact that the cause of the low quality of butters coming from Siberia and other cold climates is the want of attention on the part of the producers to the comfort and feeding of the cattle.

In the hot weather, as stated above, the butters, as a rule, show a decrease in the Reichert-Wollny figure, in the soluble acids, and also in the specific gravity; the fall in these figures is accompanied by a rise in the Zeiss figure, in the amount of insoluble acids and in the Koettstörfer number. To what extent this is due to the discomfort the cows experience and to what extent to the unsatisfactory condition of the pasture, at this time of the year, is hard to determine. The figures obtained for the samples from Wrotham Park, Hollesley Bay and Brora, seem to point to the fact that the former has, by far, the greater influence.

It is certain that when the cows are exposed to the weather during the autumn, when the nights are damp and cold, the butter-fat they produce is affected in the following ways. There is a fall in the specific gravity of the fat, in the Reichert-Wollny figures and in the proportion of soluble acids, together with a corresponding rise in the Zeiss figure, the Koettstörfer number and the proportion of insoluble acids. This continues until the cows are placed in stall and given special fodders, when a rise in the Reichert-Wollny figure, in the proportion of soluble acids and in the specific gravity, accompanied by a fall in the Zeiss and Koettstörfer numbers and the insoluble acids, is noticed.

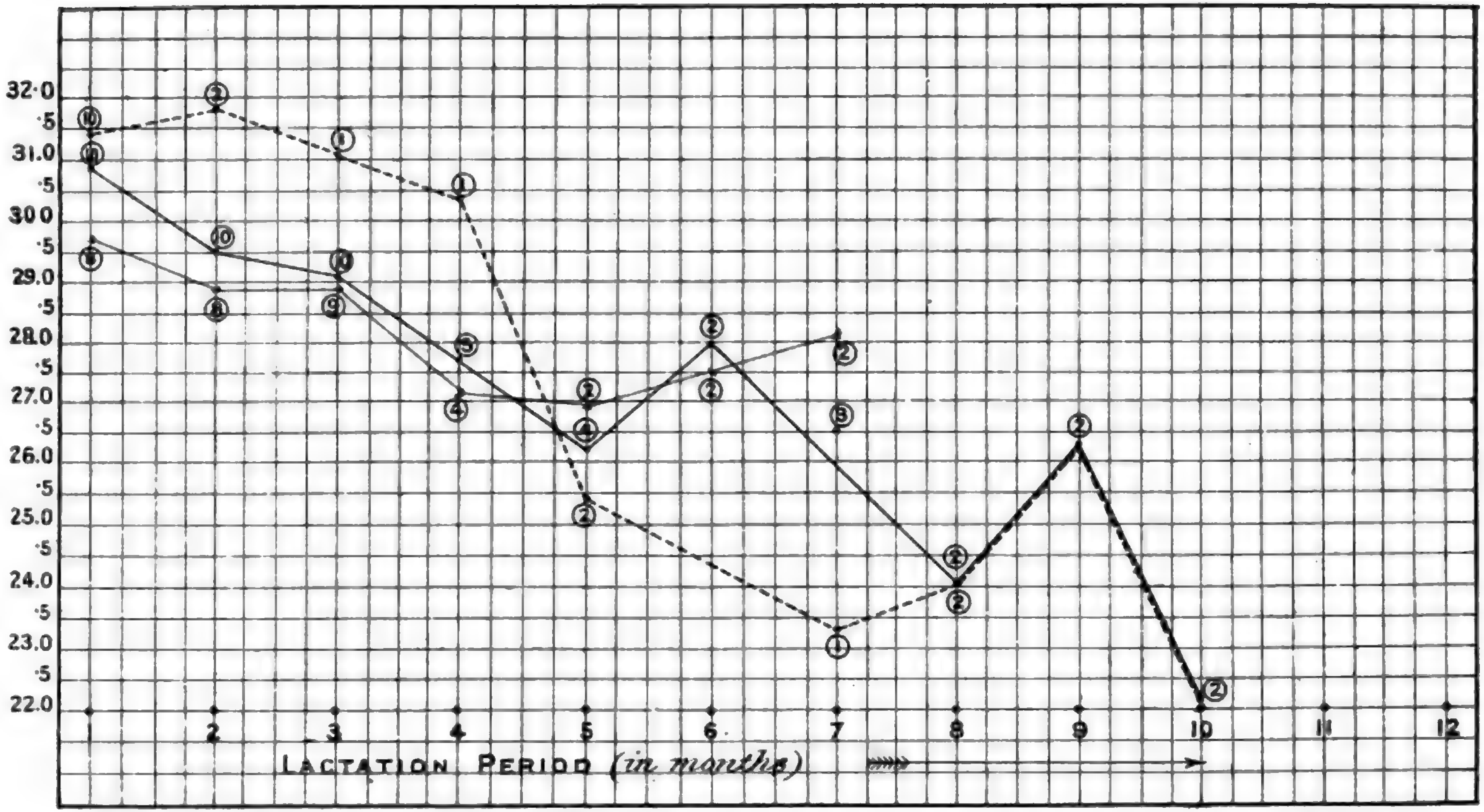
Owing partly to the manner in which particulars concerning "Lactation Period" were given in most cases, and partly to the other influences which would tend to obscure the changes in the composition of the fat brought about by this factor, it is difficult to come to any very definite conclusions with regard to its effect upon the various characteristics of the fat. It appears that change of food and other conditions of living produce a greater variation in the composition of butter in the case of cows which are late in their lactation-periods than in the case of cows which are in full milk, or nearly so.

The series of samples from Wrotham Park and East Langwell gave very uniform analytical results. At these farms the herds always included cows nearly in full milk; those cows which were nearly dry being turned out from time to time and replaced by others. Butters coming from farms where this "weeding out process" was not adopted do not, as a rule, give such uniform results. For example, at Latheron Wheel, where, as far as food, the time of stalling, and other conditions are concerned, the cows are practically on a level with those at East Langwell, the butters do not show the same uniformity of composition, variation being particularly noticeable in the case of the Reichert-Wollny figure.

With the aid of the results—which are, unfortunately, only few—bearing on the connection between lactation-period and Reichert-Wollny figure, I have endeavoured to construct a curve showing the connection graphically. The curve is appended.

Government Laboratory, February, 1903.

THE INFLUENCE OF THE LACTATION PERIOD UPON THE REICHERT-WOLLNY FIGURE.



——— Shews the Curve for the whole year.

- - - - - ,, ,, ,, ,, October, November, December, January, February, March.

——— ,, ,, ,, ,, April, May, June, July, August, September.

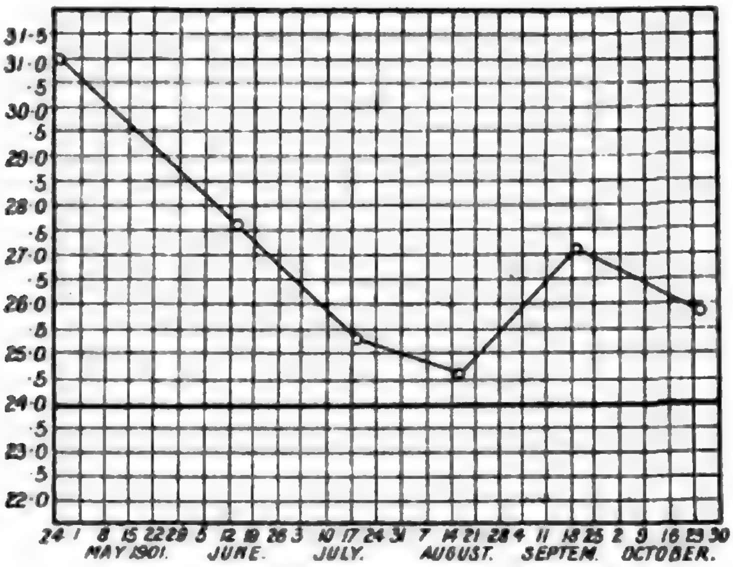
Each point shews the average Reichert-Wollny figure of the number of samples indicated by the figure inside the circle.

3878. 3. 1903.

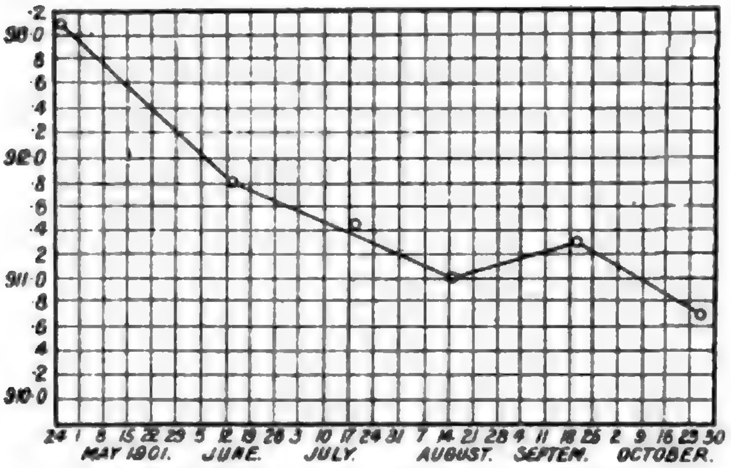
Weller & Grahams Ltd Litho London.

Breed of Cows: *Red Polled.*
Number of Cows: 2
Lactation Period: *April 1 month; May 1 mth; June 3 mths. July 4 mths; August 5 mths.; Sept. 6 mths.; Oct. 7 mths.*
Special Fodder: *In April, carrots, bran, hay; June, cotton cake, bran; after June, bran only.*

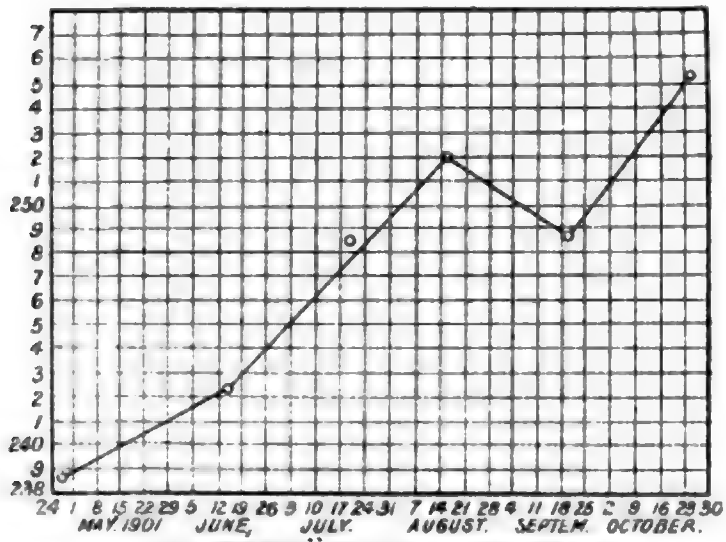
COWS OUTSIDE
Special fodder.



REICHERT WOLLNY FIGURE.



SPECIFIC GRAVITY AT 100° F.



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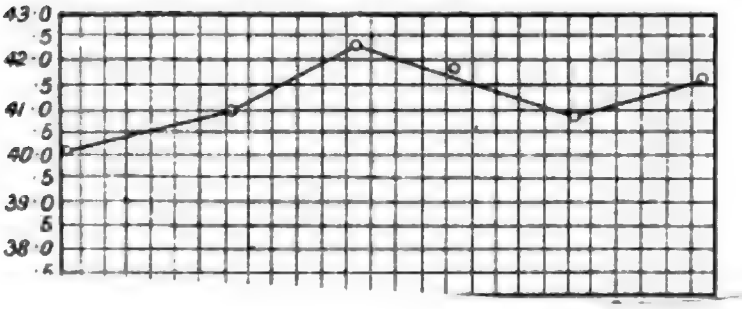
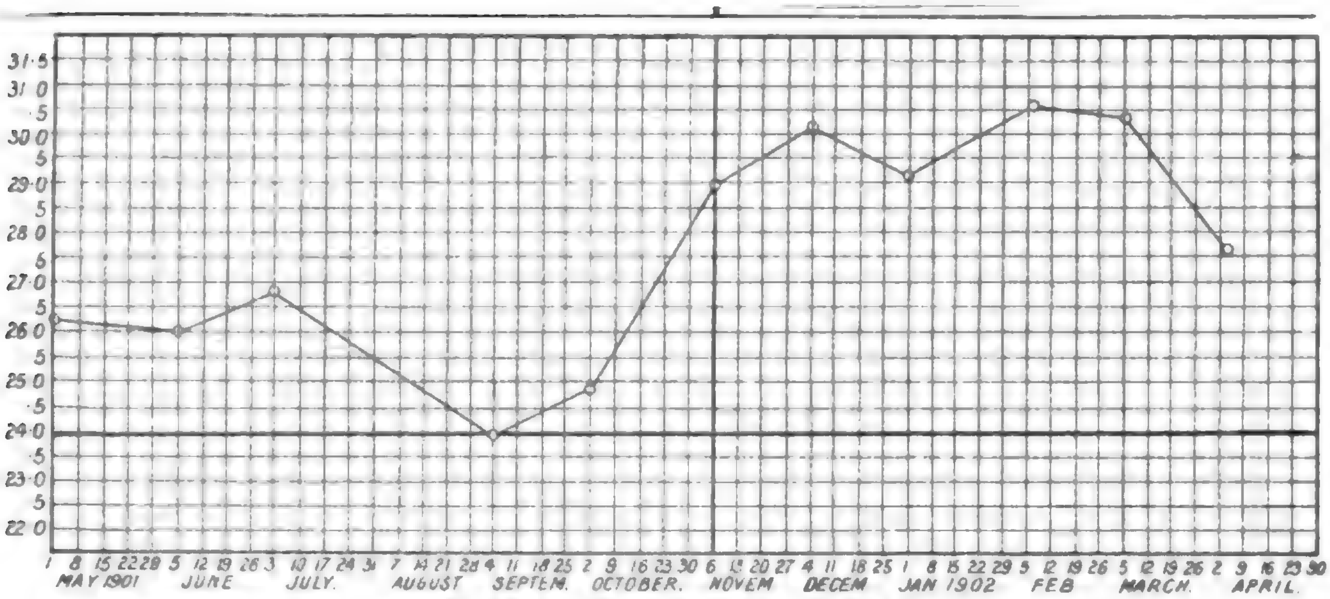
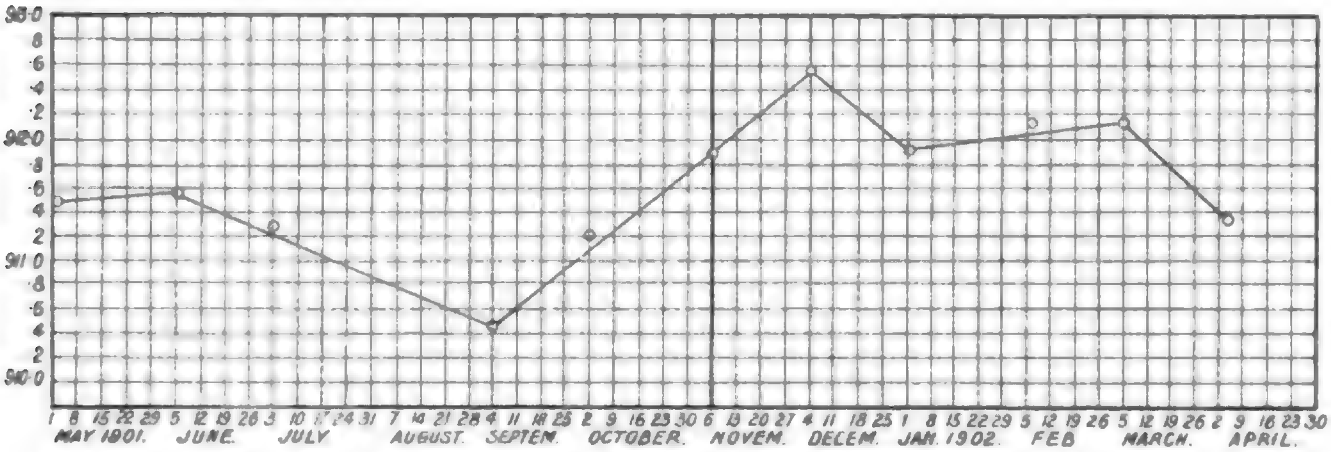
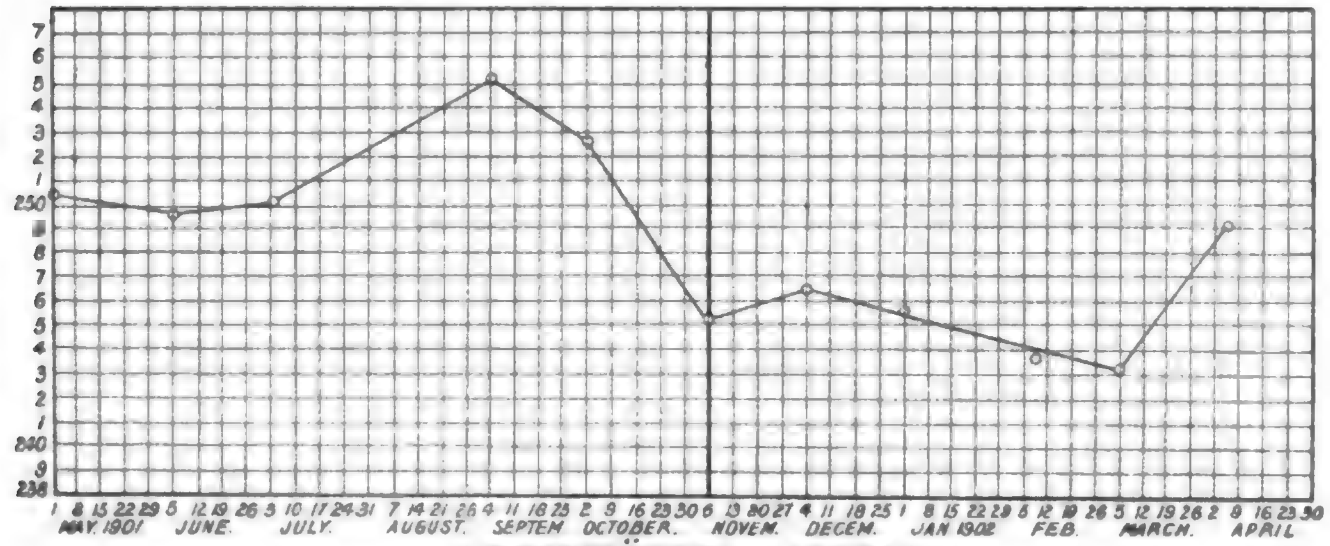




REICHERT WOLLNY FIGURE.



SPECIFIC GRAVITY AT 100° F.



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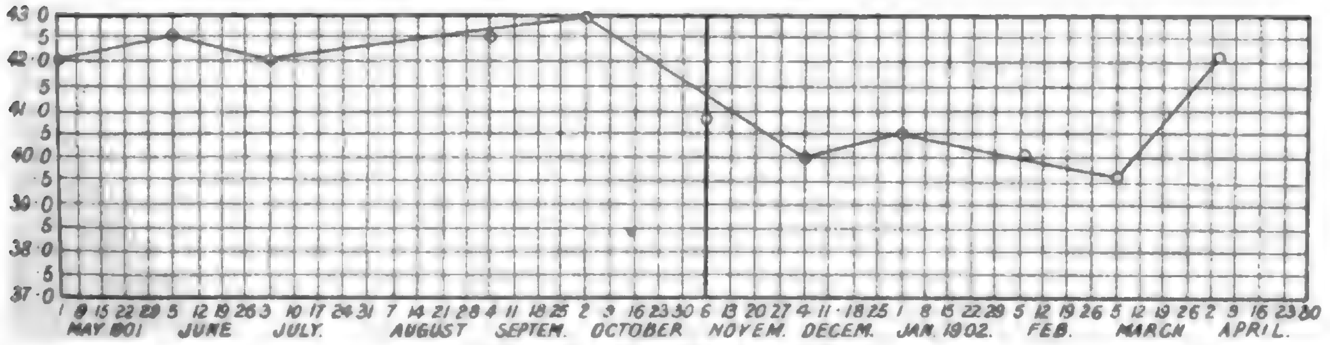

ZEISS FIGURE AT 45°C.

5678.4.05

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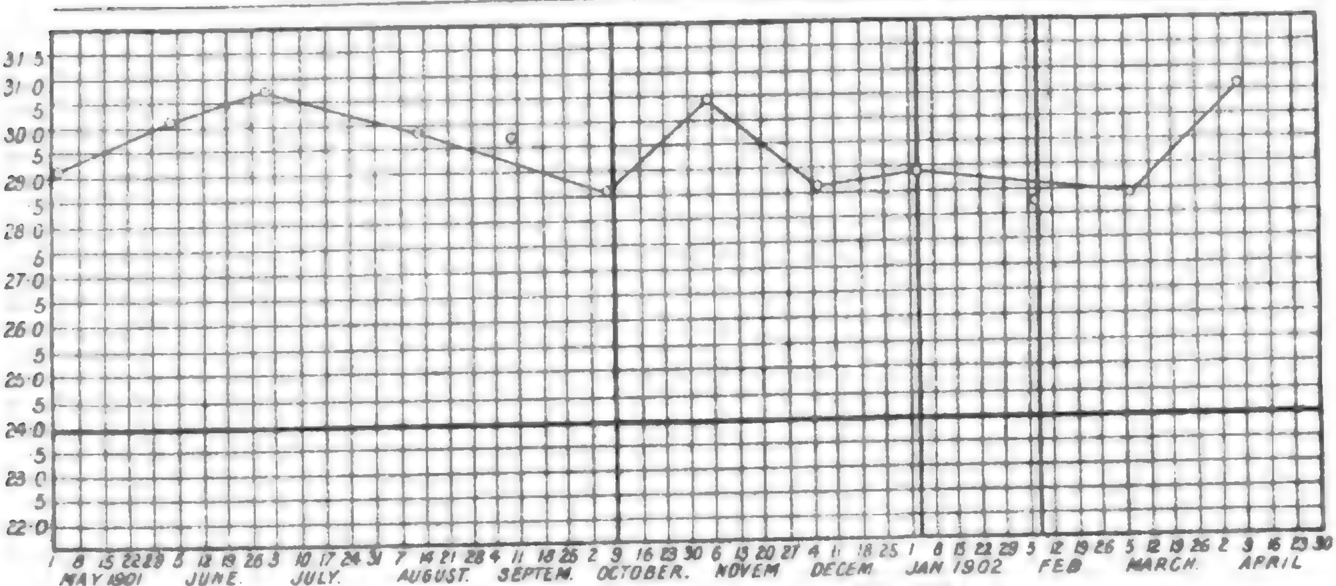
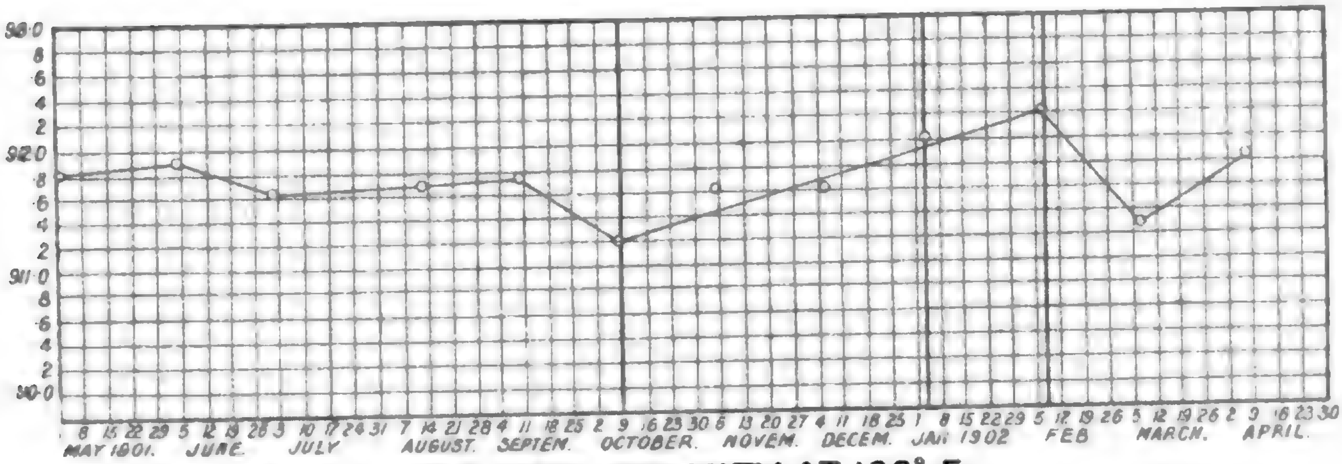
4. WROTHAM PARK FARM, BARNET.

BREED OF COWS: *Jerseys*
NUMBER OF COWS: *Varying from 10 to 16*
LACTATION PERIOD: *May, from 8 months to 1 week, June 7 mths. to 5 wks. July ? to 3 wks.; Aug. 9 mths. to 3 mths. Sept. 10 to 4 mths., Oct. 10 to 1 mth, Nov. ? to 1 month Dec. ? to 2 mths, Jan. ? to 2 wks., Feb. ? to 3 wks. March ? to 2 wks., April ? to 1 mth.*

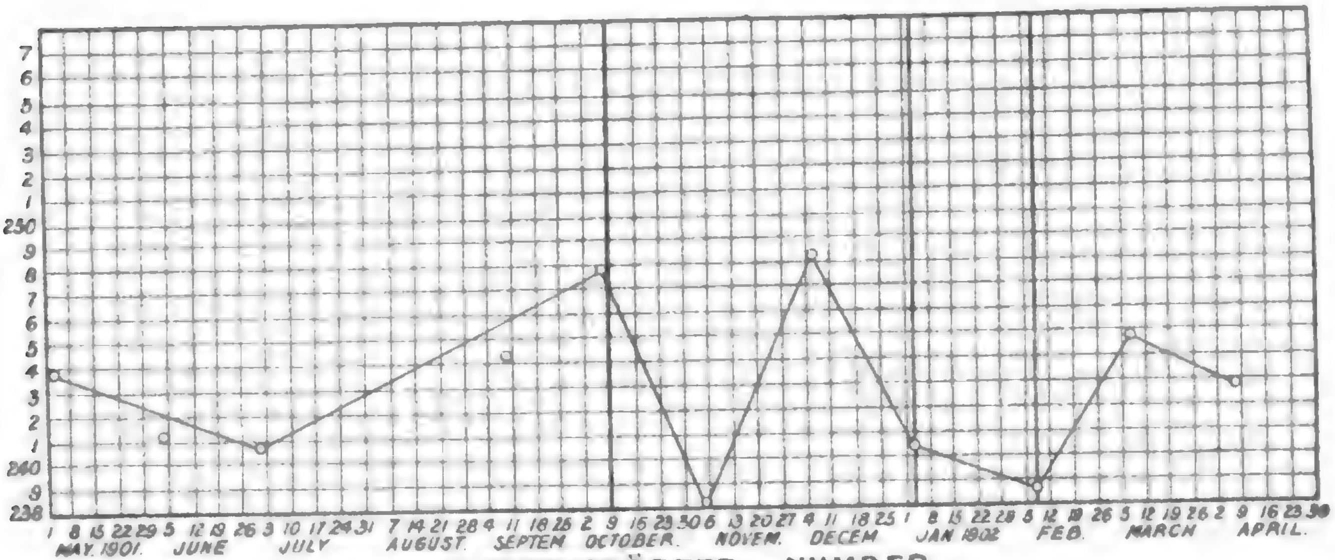
COWS OUTSIDE. *No special fodder.*	COWS OUTSIDE DURING THE DAY INSIDE AT NIGHT. *Special fodder*	COWS INSIDE *Special fodder*	COWS OUTSIDE IN DAYTIME *Special fodder.*



REICHERT WOLLNY FIGURE.



SPECIFIC GRAVITY AT 100° F.



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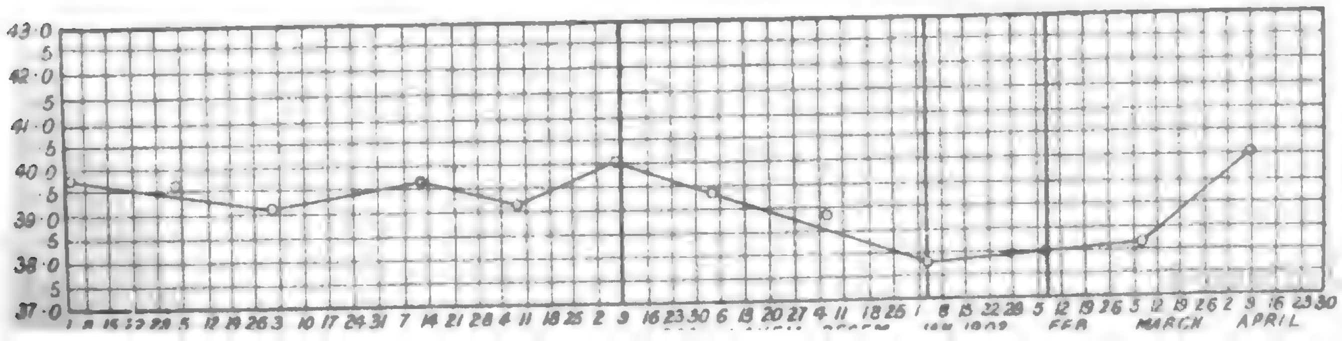
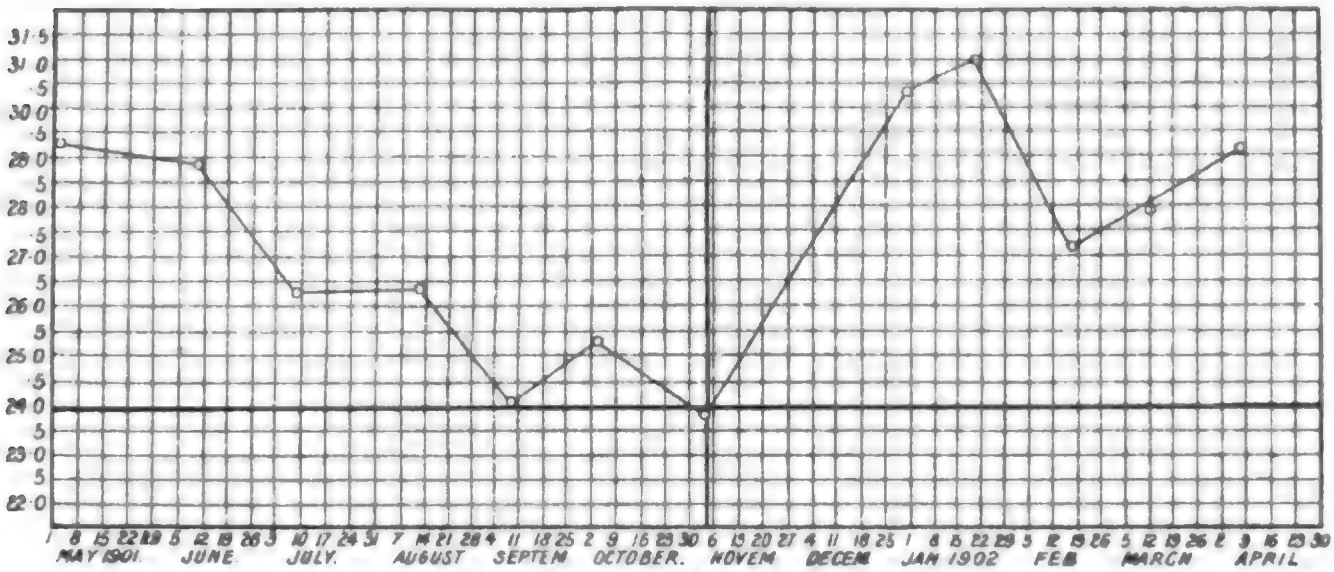


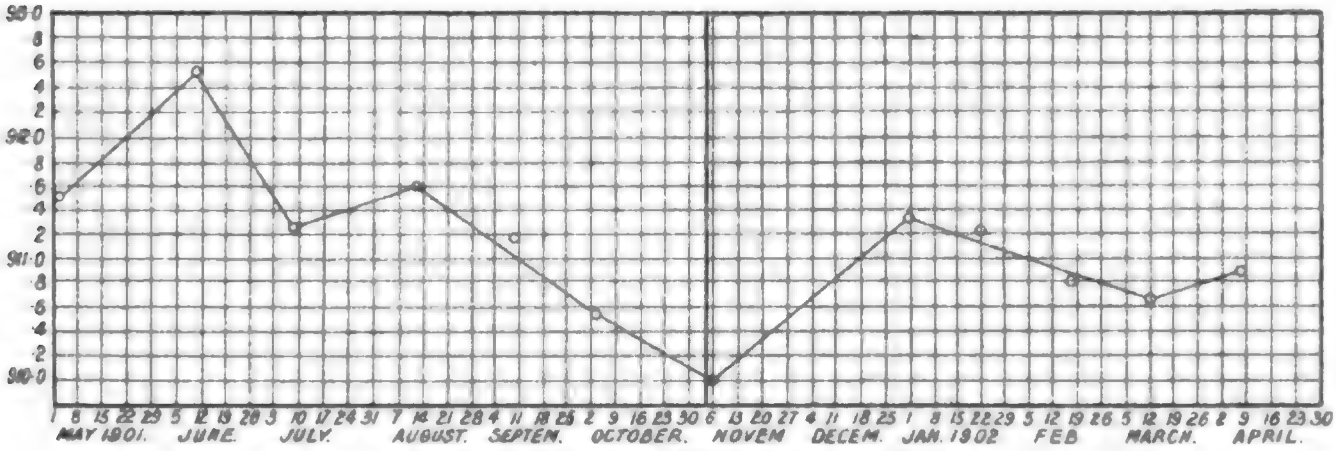
5. CUMBERLAND & WESTMORELAND C.C. FARM, NEWTON RIGG, PENRITH.

Breed of Cows: *Shorthorns*
Number of Cows: *8 to 15*
Lactation Period: *May 7 to 1 mths., June 8 to 2 mths., July 9 to 3 mths; Aug. 12 to 1 mths., Sept. 9 to 2 mths., Oct. 1 to 9 mths; Nov. 11 to 1 mths., Dec. 12 to 2 mths; Jan. 12 to 2 mths; Feb. 10 to 2 mths., March 9 to 1 mths; April 6 to 1 mths..*

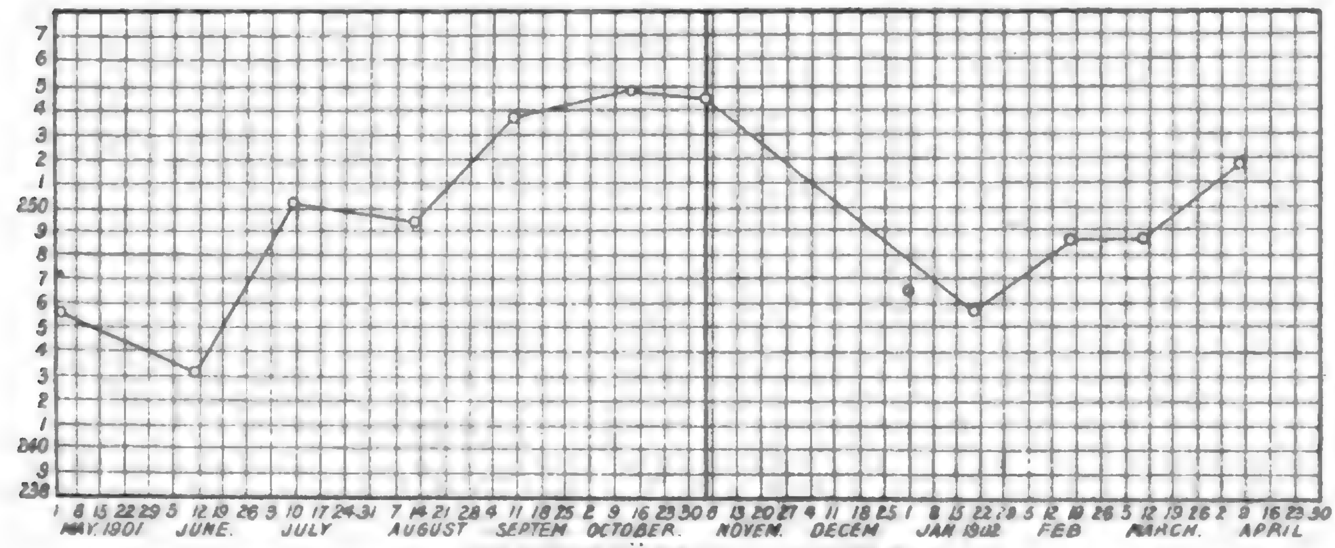
COWS OUTSIDE *Some cotton cake & oatstraw in addition to grass.*	**COWS INSIDE.** *Special fodder.*



REICHERT WOLLNY FIGURE.



SPECIFIC GRAVITY AT 100° F.



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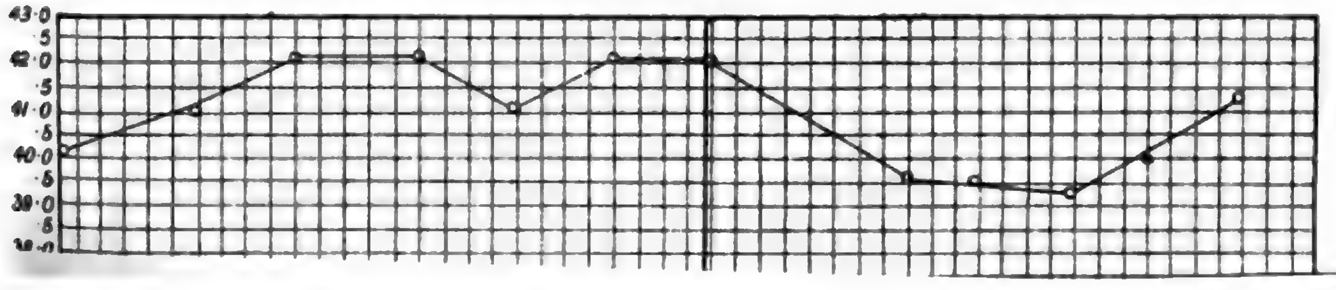


6. E.& W. RIDINGS C.C. FARM, GARFORTH, LEEDS.

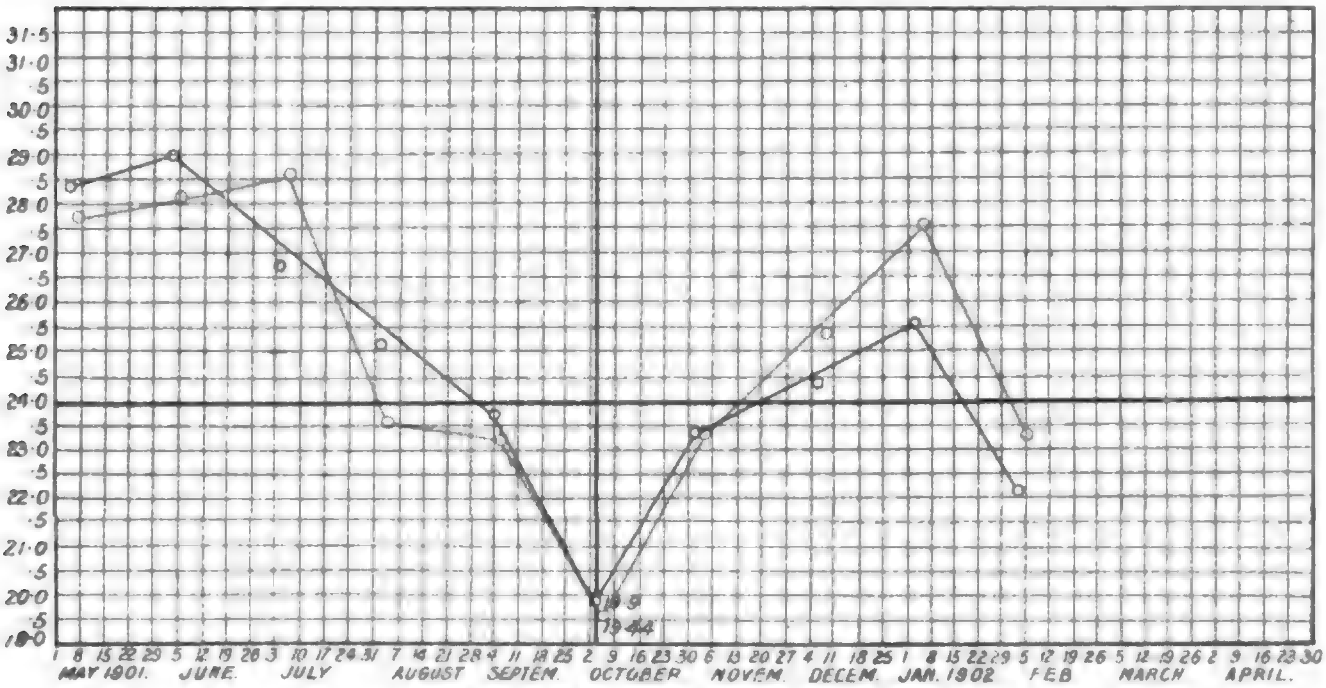
BREED OF COWS: *Shorthorns.*

NUMBER OF COWS: *3 in herd represented by black line.*
6 „ „ „ red „

LACTATION PERIOD: *In the former herd the cows calved all at the same time approximately; in the latter the cows calved at various dates, lying within a period of three months.*

	BLACK LINE.	RED LINE.
May	*2 weeks*	*3, 2 weeks; 3, 2 mths*
June	*6 „*	*?*
July	*10 „*	*4 to 1 mths.*
Aug.	*14 „*	*5 „ 2 „*
Sept.	*5 months*	*6 „ 4 „*
Oct.	*6 „*	*6 „ 5 „*
Nov.	*7 „*	*8 „ 7 „*
Dec.	*8 „*	*8 „ 6 „*
Jan.	*9 „*	*9 „ 7 „*

SPECIAL FODDER: *In May, cotton cake, maize, bran & hay. Afterwards till end of Aug. cotton cake; in Sept. cotton cake, grain, gluten meal & maize meal; in Oct. cotton cake; in Nov. cotton seed meal, bran & hay; In Dec. cotton seed meal, bran & hay; in Jan. cotton seed meal, bran, hay & maize.*



COWS ALL OUTSIDE.
Special fodder.

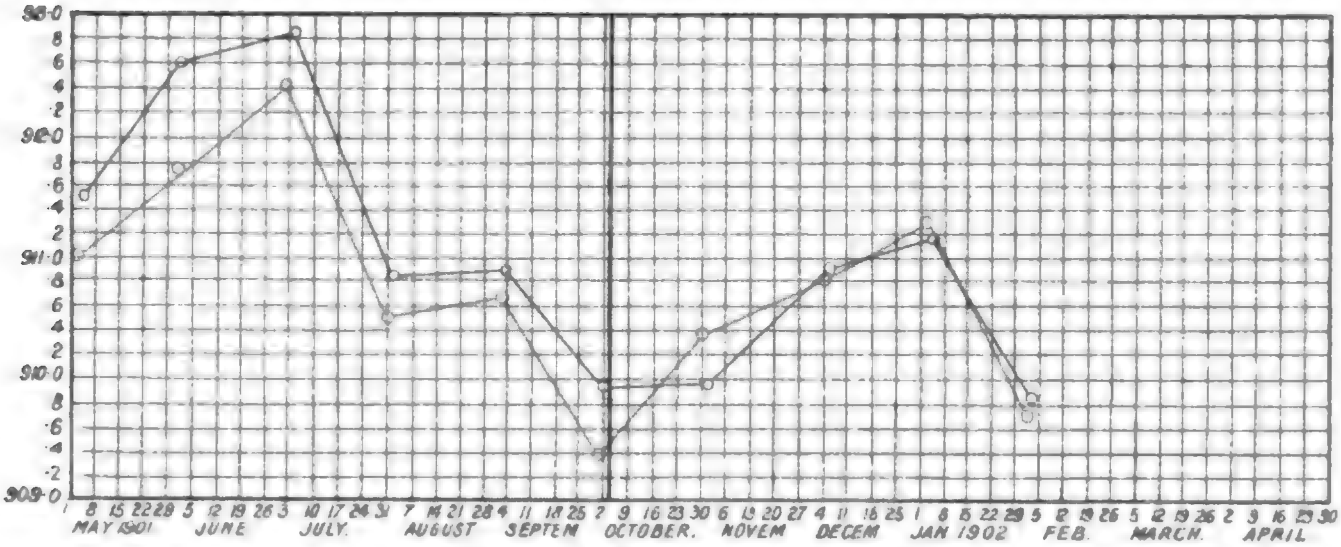
COWS INSIDE.
Special fodder.

REICHERT WOLLNY FIGURE.

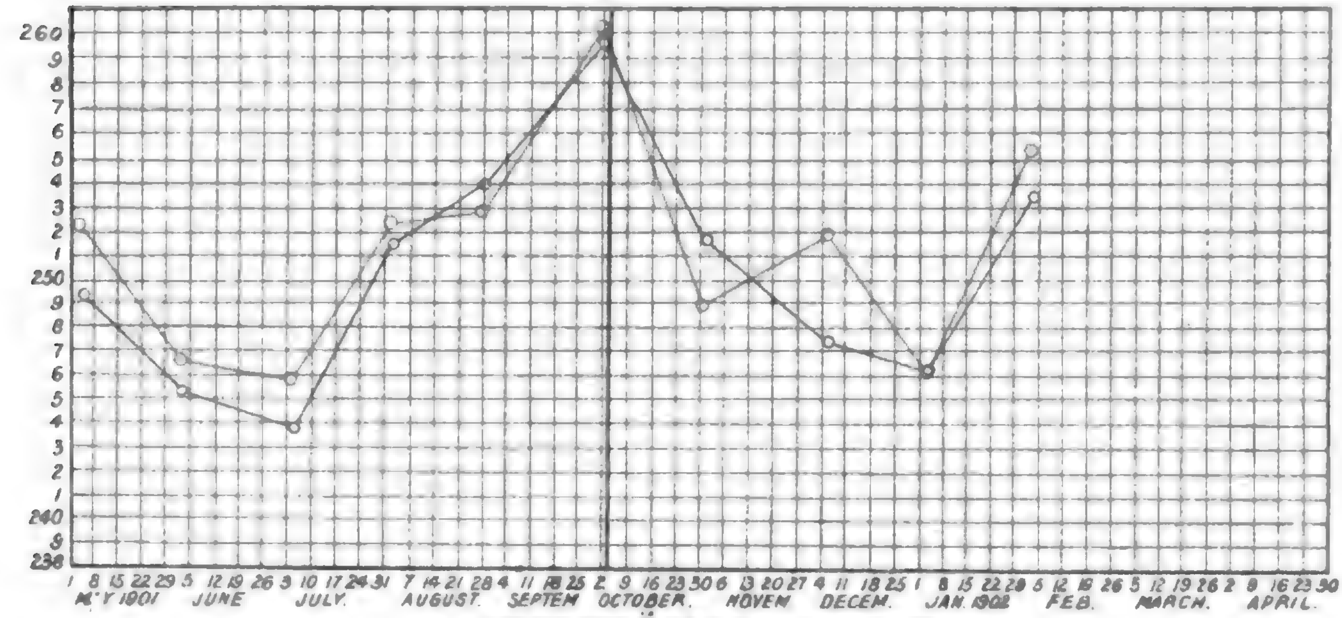
3878.4.03.

Weller & Graham, Ltd Litho London.

6. *Continued.*



SPECIFIC GRAVITY AT 100° F.



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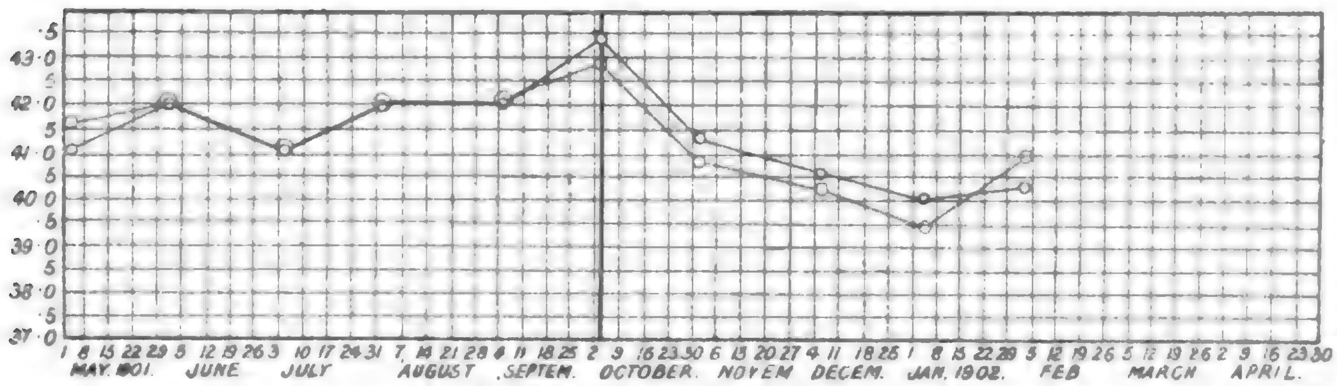


ZEISS FIGURE AT 45°C.

3878.4.03.

Waller & Graham, Ld Litho, London.

7. BUSCOT PARK DAIRY, FARINGDON, BERKS.

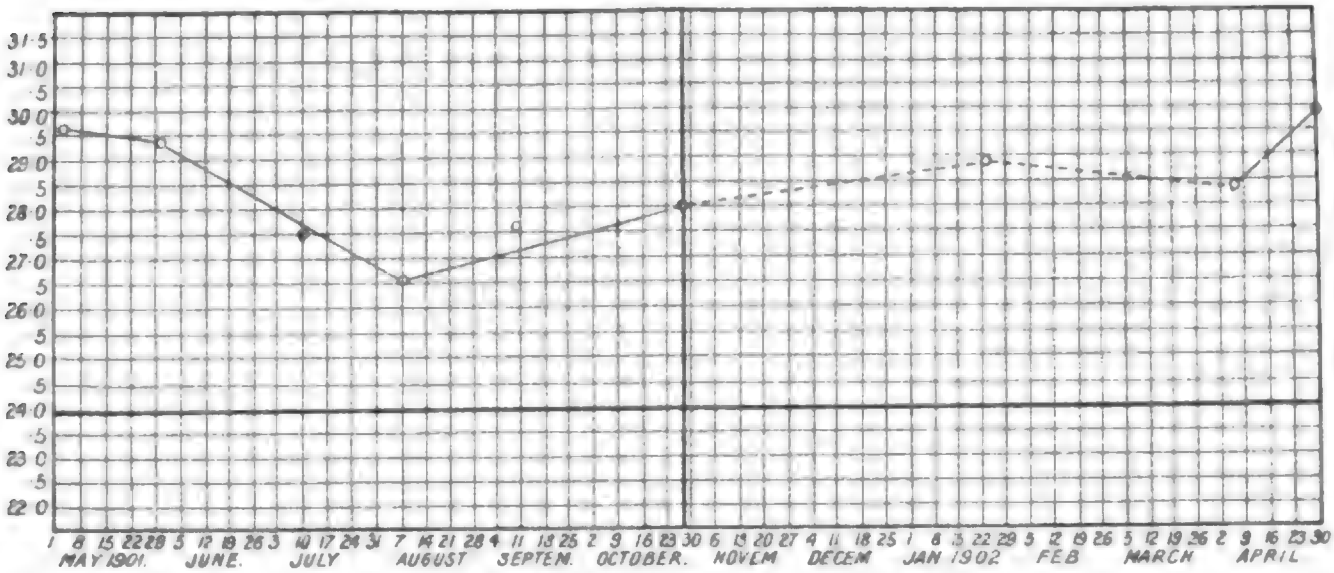
BREED OF COWS: *Shorthorns and Jerseys.*

NUMBER OF COWS: *Large herd varying from 68 Shorthorns & 4 Jerseys to 60 Shorthorns.*

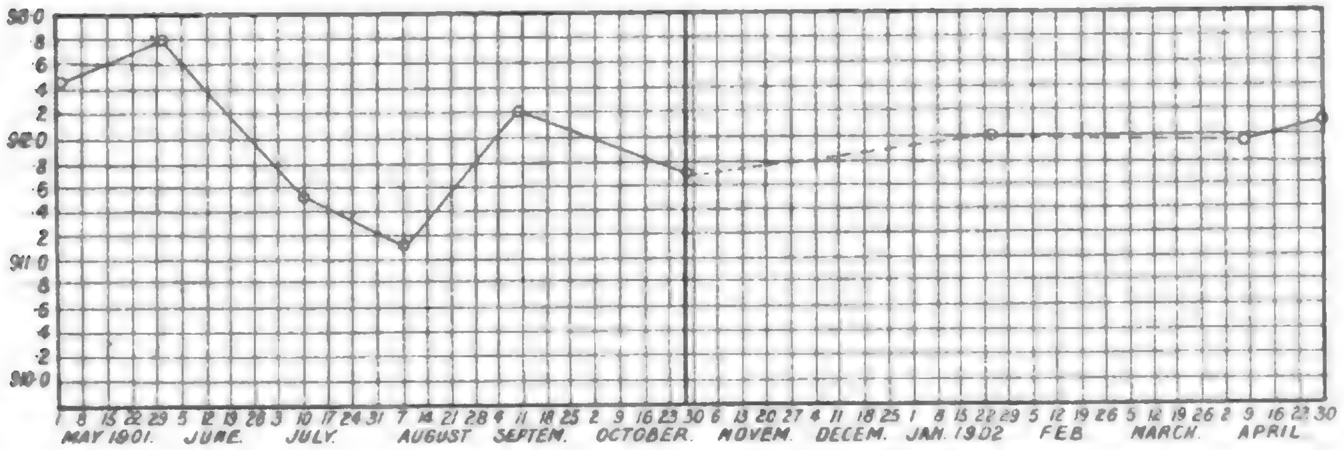
LACTATION PERIOD: *In May 8 to 1 mths. June 9 to 2 mths., July 10 to 1 mths., Aug. 10 to 4 mths., Sept. 11 to 5 mths., Oct. 9 to 1 mths, Jan. 6 to 1 mths. April 6 to 1 mths. May 7 to 2 mths.*

SPECIAL FODDER: *In May, Cotton cake, oatstraw, chaff, mangolds & meadow hay. From June to the end of Oct. pasture & cotton cake. In Jan. & April, mangolds, cotton cake, oatstraw & clover, In May, at grass, no other food.*

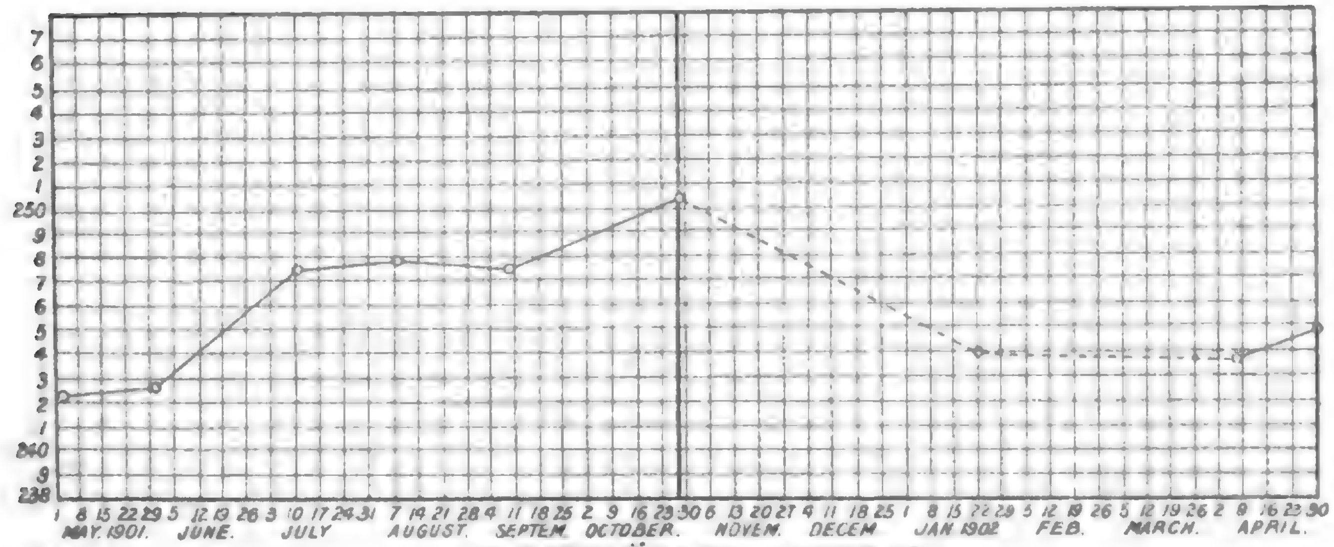
COWS OUTSIDE	COWS INSIDE.
Special fodder, cotton cake	*Mangolds, hay, cotton cake, straw chaff.*



REICHERT WOLLNY FIGURE.



SPECIFIC GRAVITY AT 100° F.



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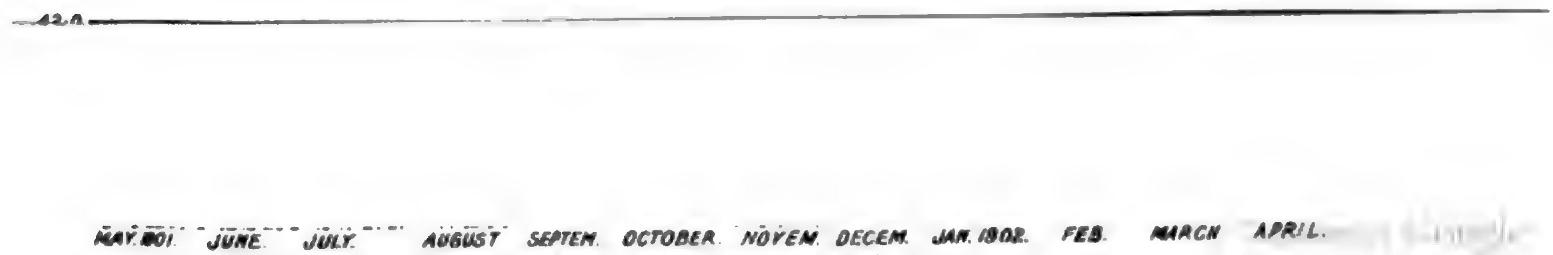


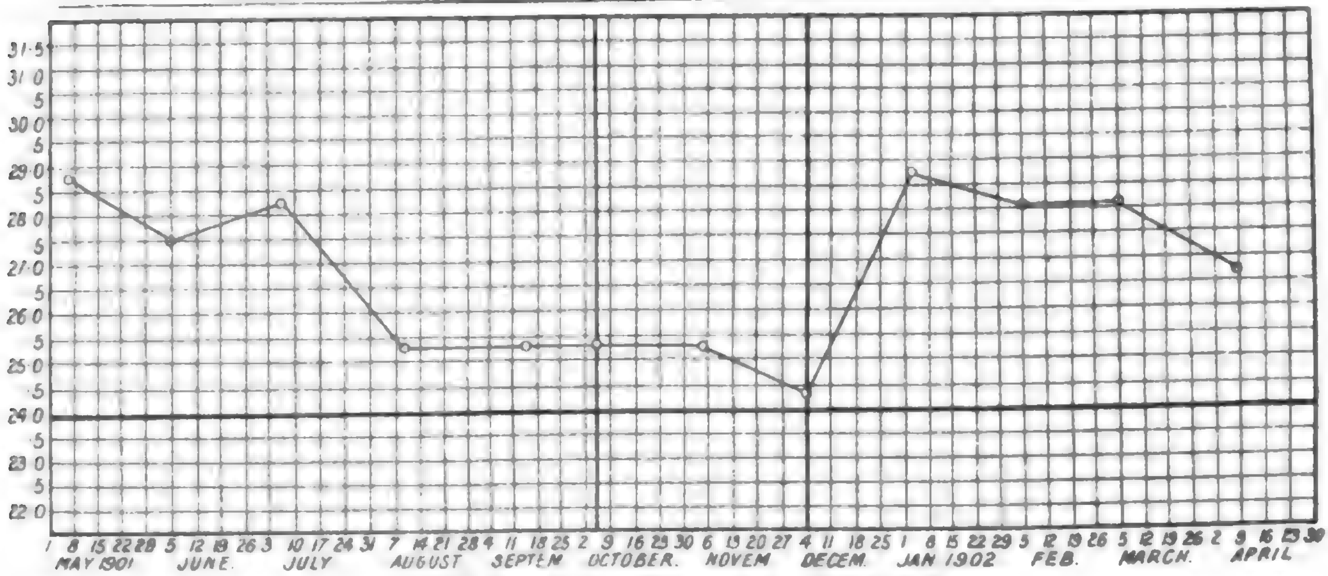
ZEISS FIGURE AT 45° C.

9. SHARCOMBE WELLS, SOMERSET

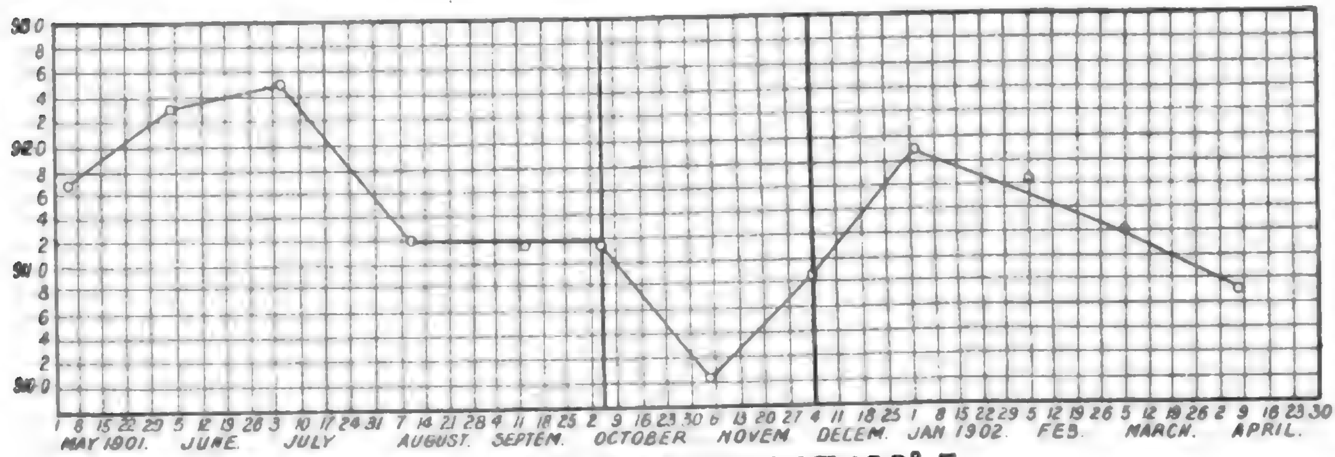
COWS OUTSIDE
Special fodder & grass.

COWS INSIDE AT NIGHT OUT IN DAY
Special fodder and grass

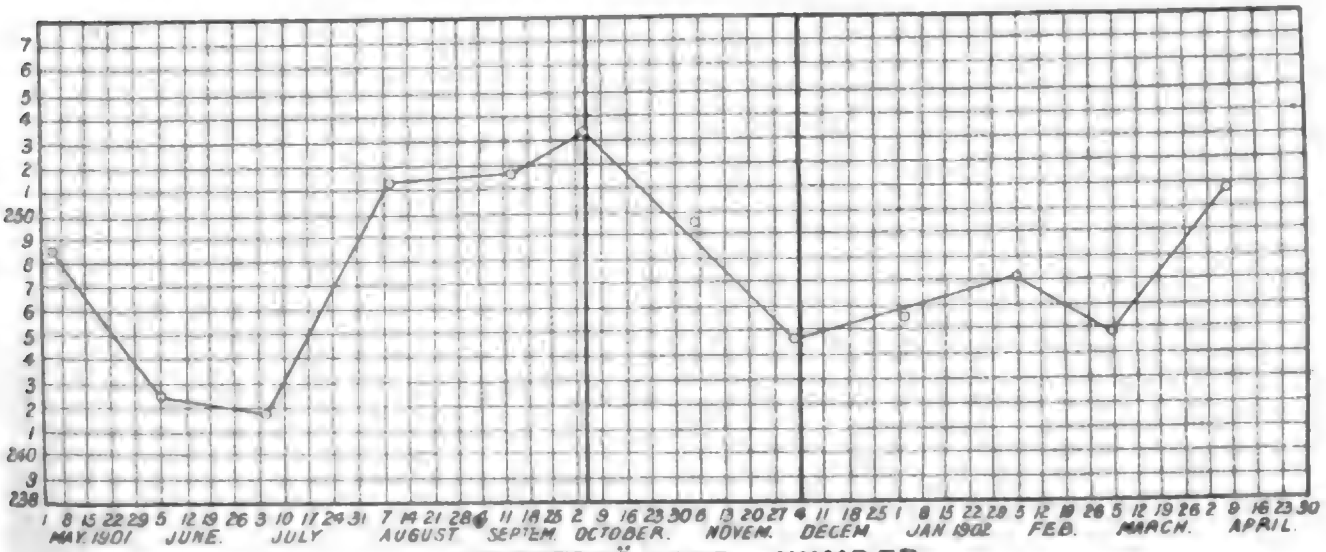
COWS INSIDE DAY AND NIGHT.
Special fodder.



REICHERT WOLLNY FIGURE.



SPECIFIC GRAVITY AT 100° F.



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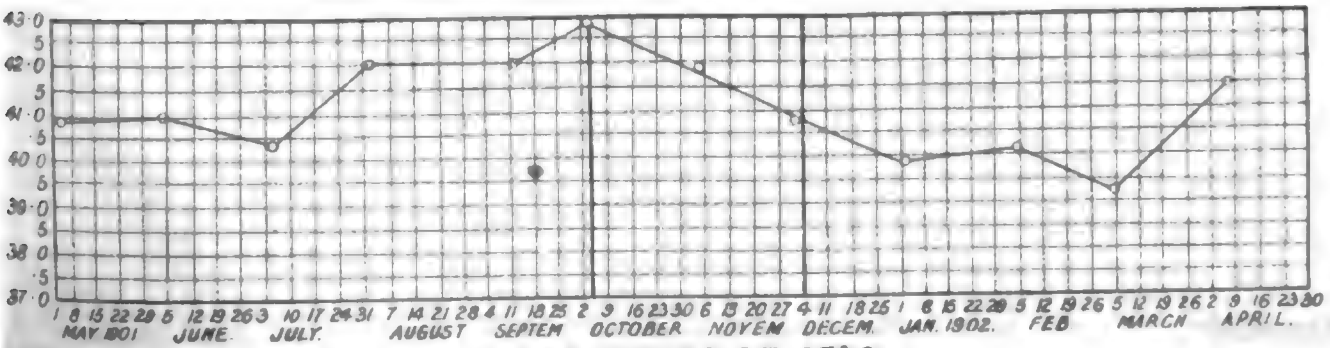


ZEISS FIGURE AT 45° C.

[illegible] Ltd. Litho London

9. SHARCOMBE WELLS, SOMERSET.

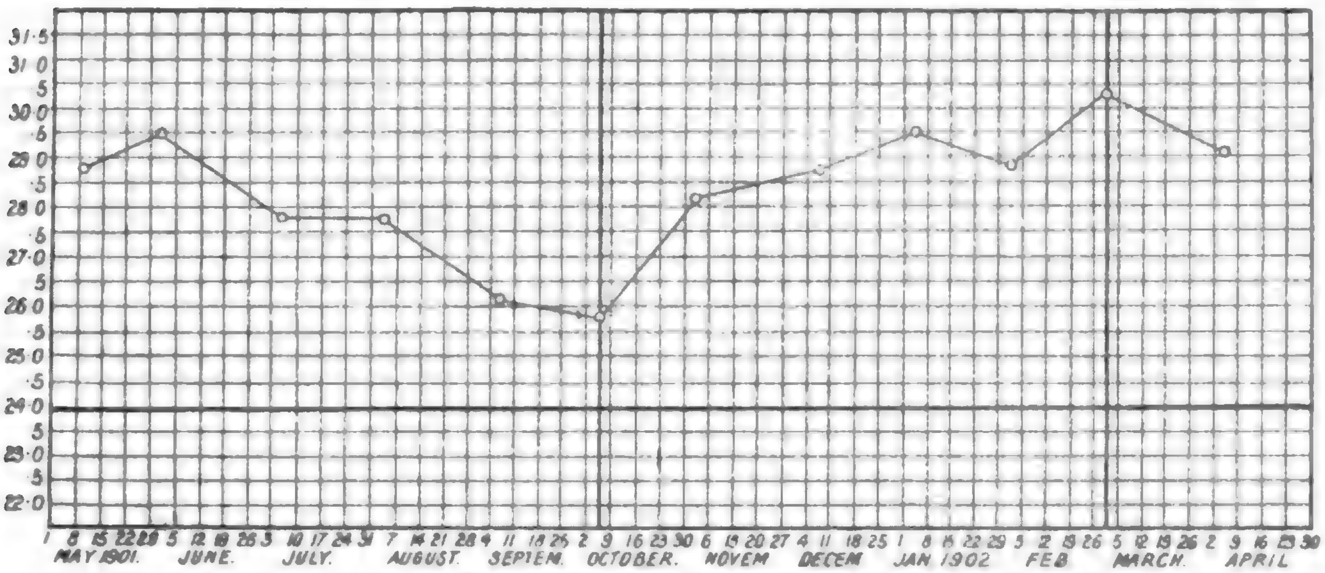
BREED OF COWS: *Jerseys.*

NUMBER OF COWS: *In May 11, June, July, Aug, & Sept, 10; in Oct. & Nov. 9; in Dec^r., Jan. & Feb. 8, in March & April 9.*

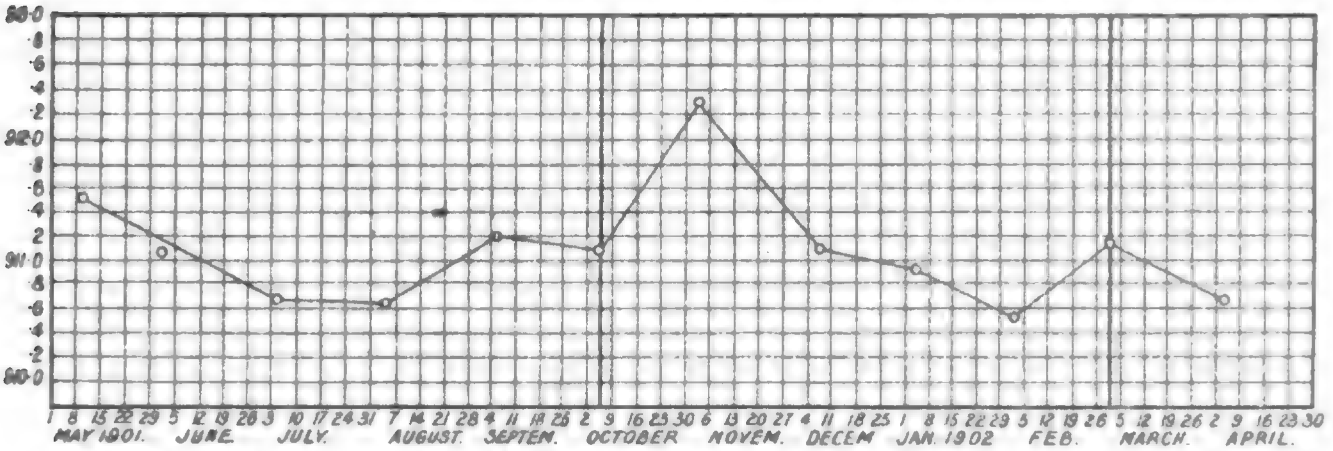
LACTATION PERIOD: *May to Sept. 7 to 2 mths. Oct. 9 to 1 mths. Nov 10 to 2 mths. Decr 9 to 2 mths. Jan. 10 to 3 mths. Feb. 10 to 3 mths. March 8 to 1 mths. April 6 to 1 mths.*

SPECIAL FODDER: *From May to Dec. Brewers' grains & cotton cake; After Decr. Carrots, grains, cotton cake & hay. In March mangolds were substituted for Carr^ts.*

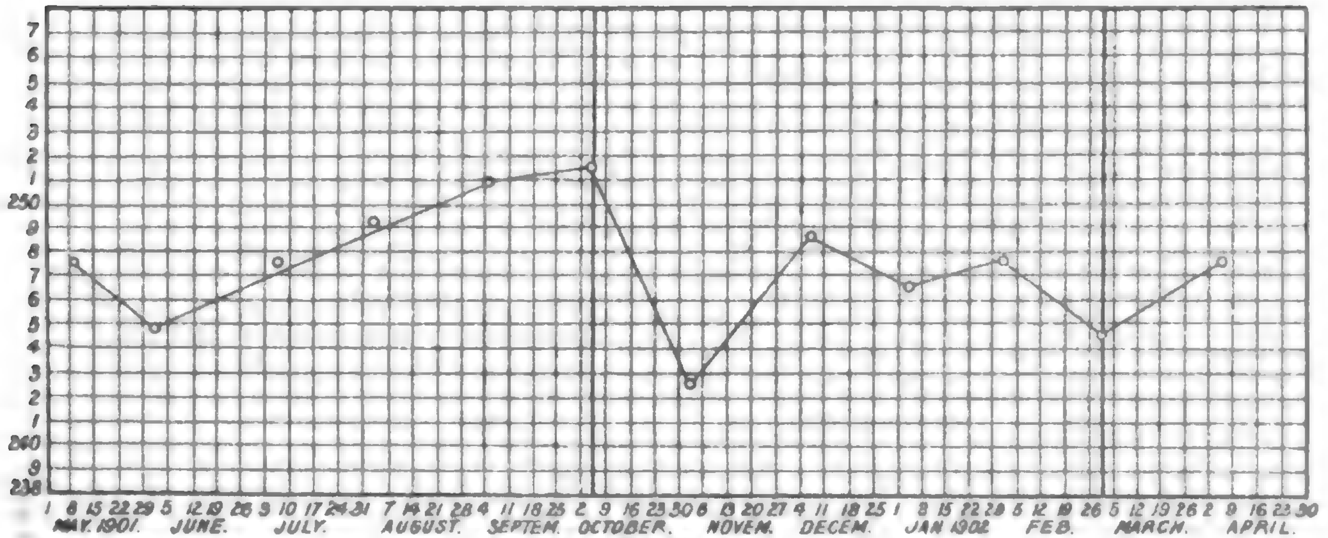
COWS AT GRASS. *Special fodder.*	COWS INSIDE *Special fodder.*	COWS OUTSIDE IN DAY INSIDE AT NIGHT. *Special fodder*



REICHERT WOLLNY FIGURE.

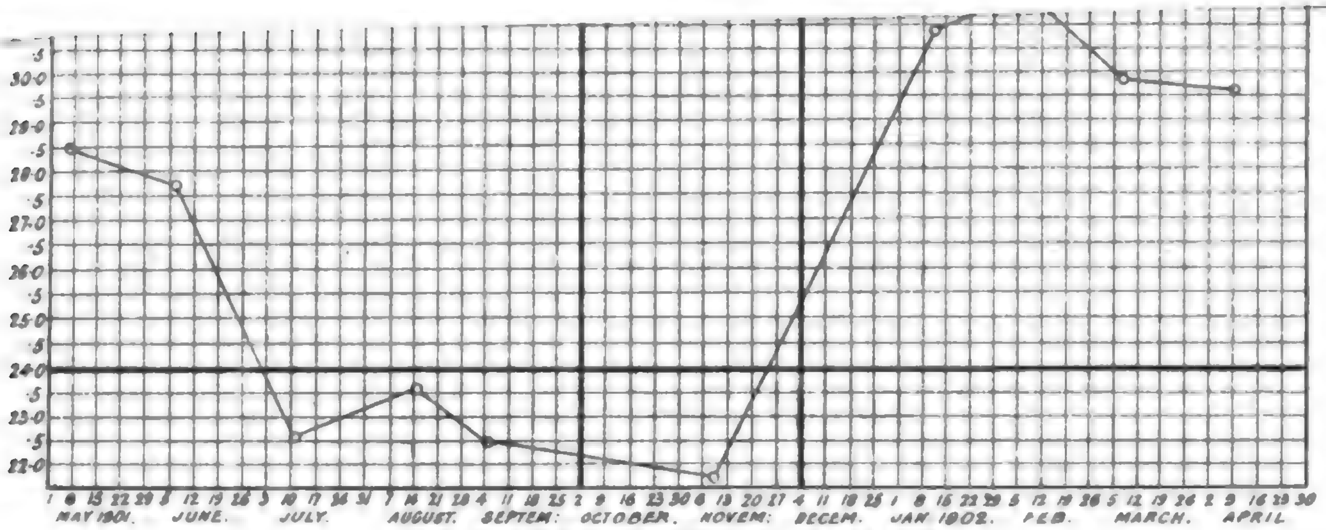


SPECIFIC GRAVITY AT 100° F.

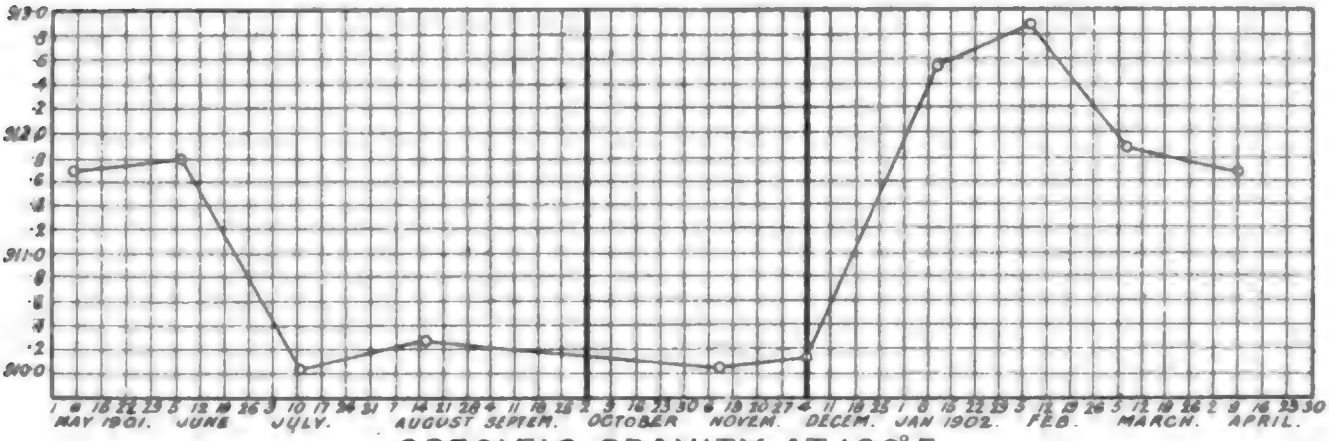


KOETTSTÖRFER NUMBER.

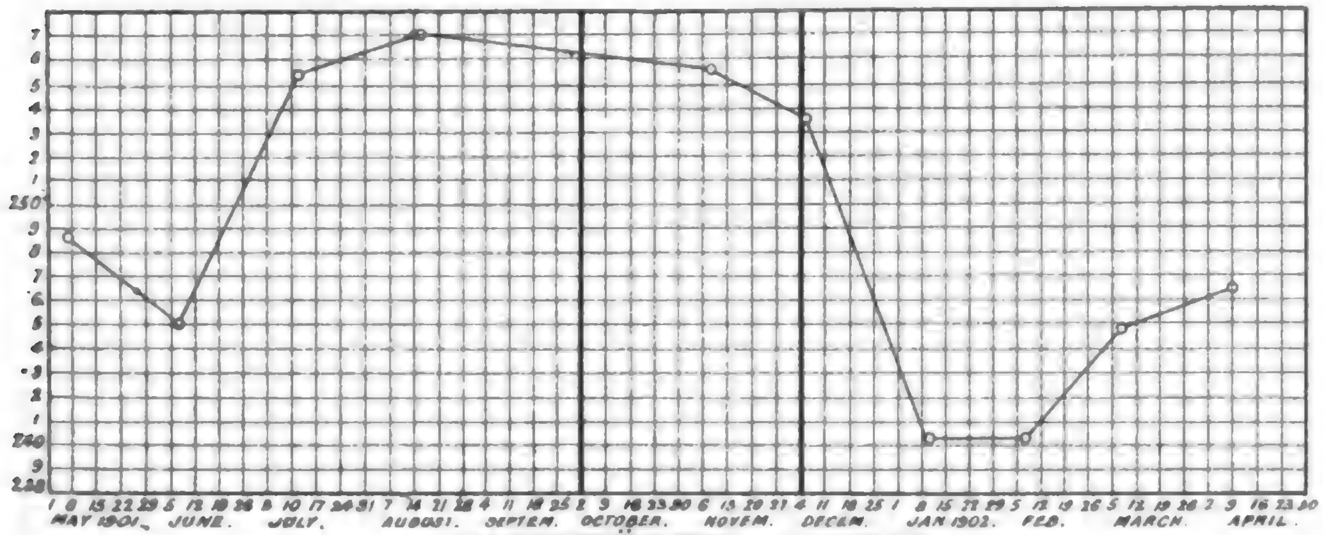
Breed of Cows: *Shorthorn.*
Number of Cows: *6.*



REICHERT WOLLNY FIGURE.



SPECIFIC GRAVITY AT 100° F.



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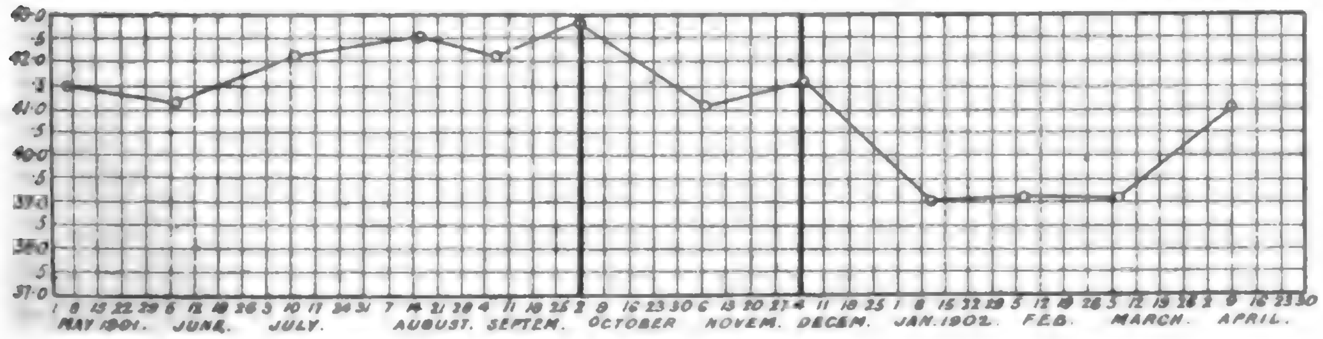


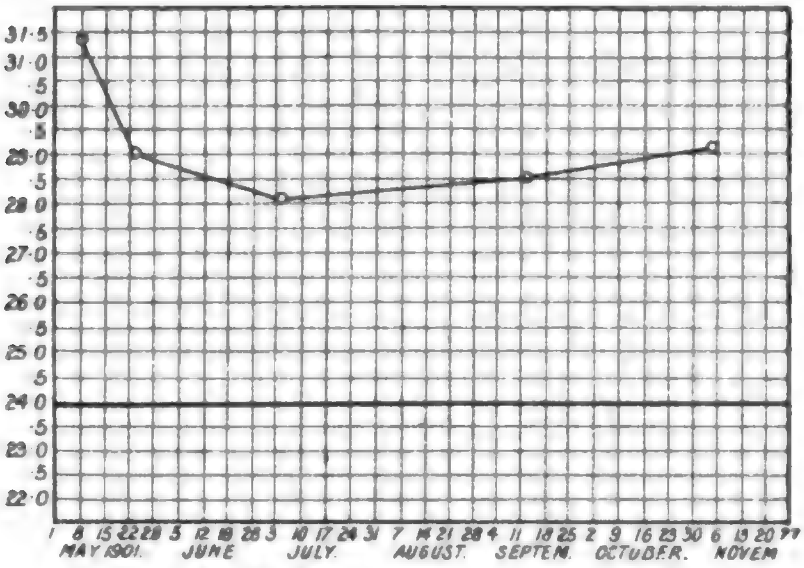
ZEISS FIGURE AT 45° C.

Waterlow & Graham's Ltd Litho London.

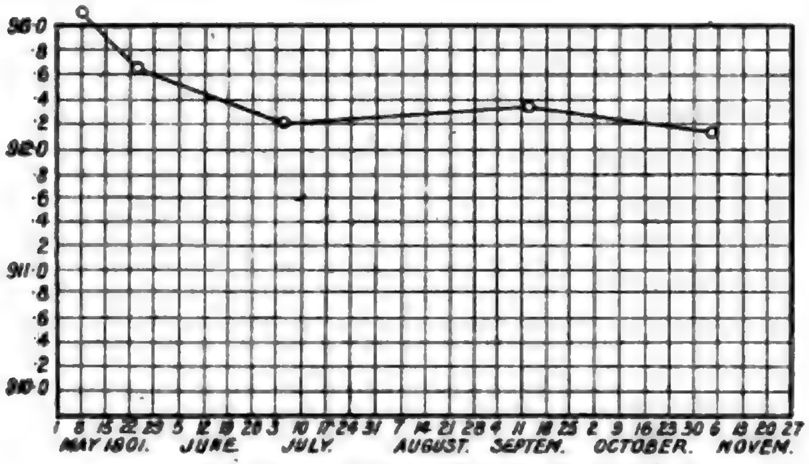
BREED OF COWS: *Shorthorn.*
NUMBER OF COWS: *6.*
SPECIAL FODDER: *in May, mangolds, bran & chaffed hay; June, chaffed hay & bran; July, bran; Aug. ?. Sept. Nil; Nov., mangolds & bran.*

COWS OUTSIDE.

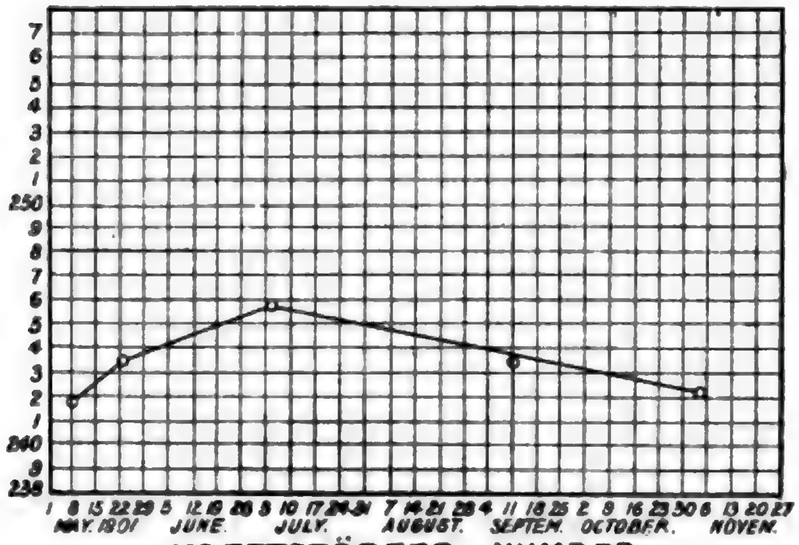
In early part & late part of year, chaffed hay, bran & mangolds.



REICHERT WOLLNY FIGURE.



SPECIFIC GRAVITY AT 100° F.



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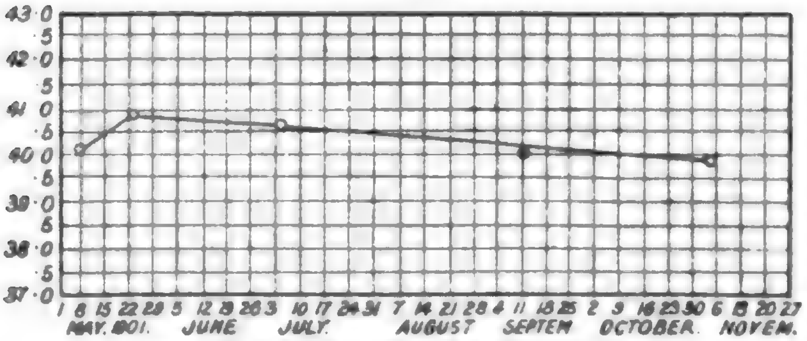


ZEISS FIGURE AT 45°C.

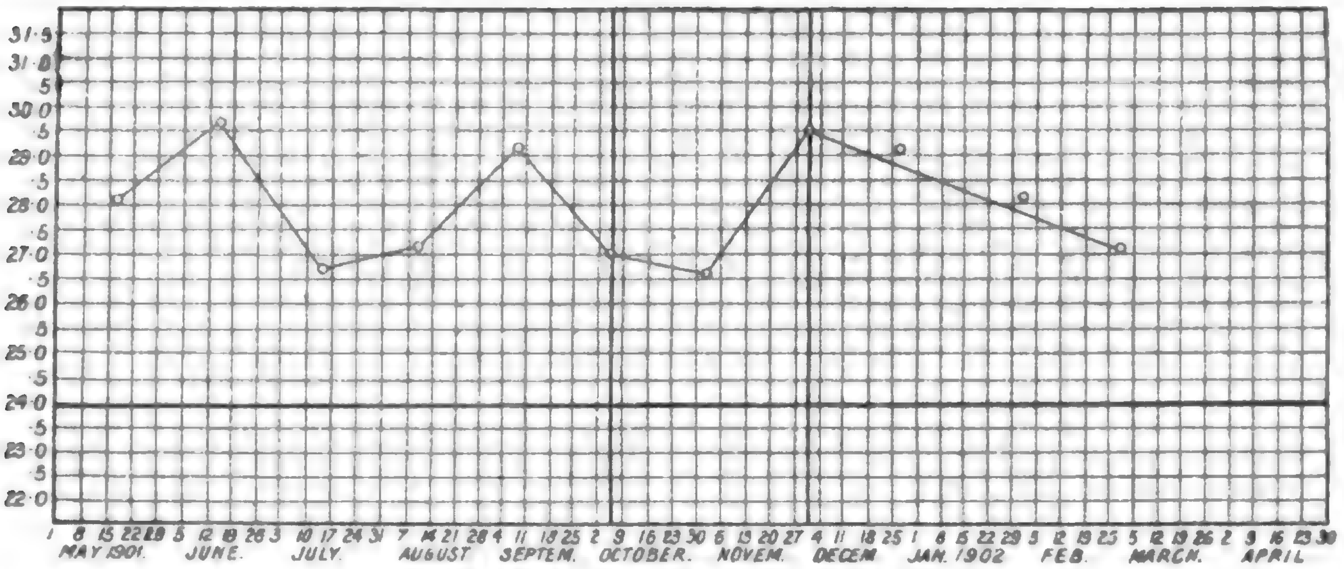
SOMERSET C.C. FARM, BICKENHALL.

Breed of Cows: *Shorthorns & Jerseys.*

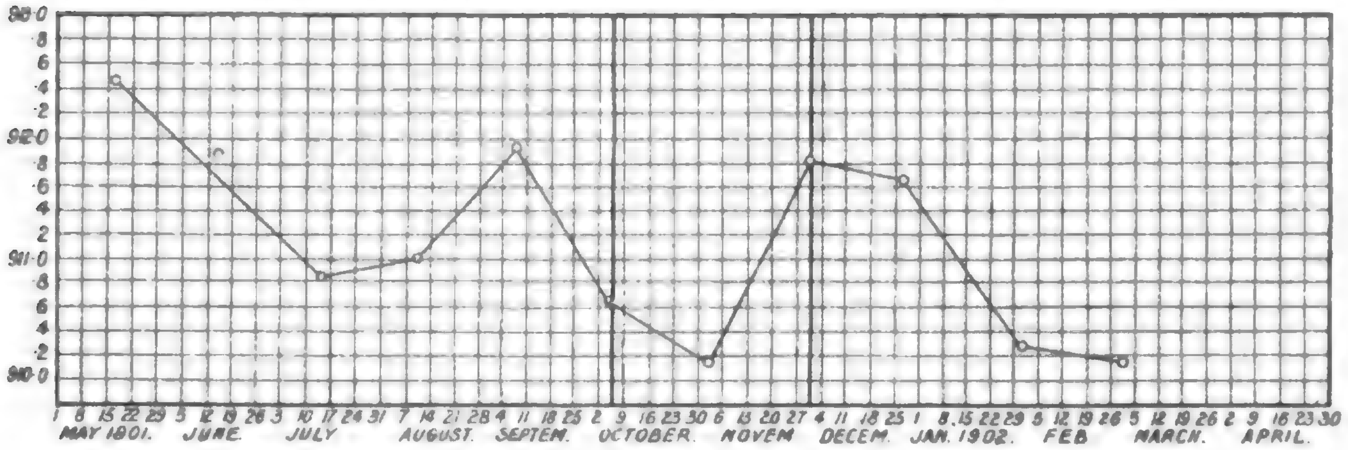
Number of Cows: *May 5 S.H. 11 Jerseys, June 5 S.H., 10 Jerseys, July 4 S.H., 11 Jerseys, Aug. 5 S.H., 11 Jerseys, Sept. ?, Oct. 3 S.H. 11 Jerseys, Nov. 4 S.H., 9 Jerseys Dec. 6 S.H. 9 Jerseys, Jan. 6 S.H., 8 Jerseys. Feb. 6 S.H., 9 Jerseys, March 6 S.H., 8 Jerseys.*

Lactation Period: *No data*

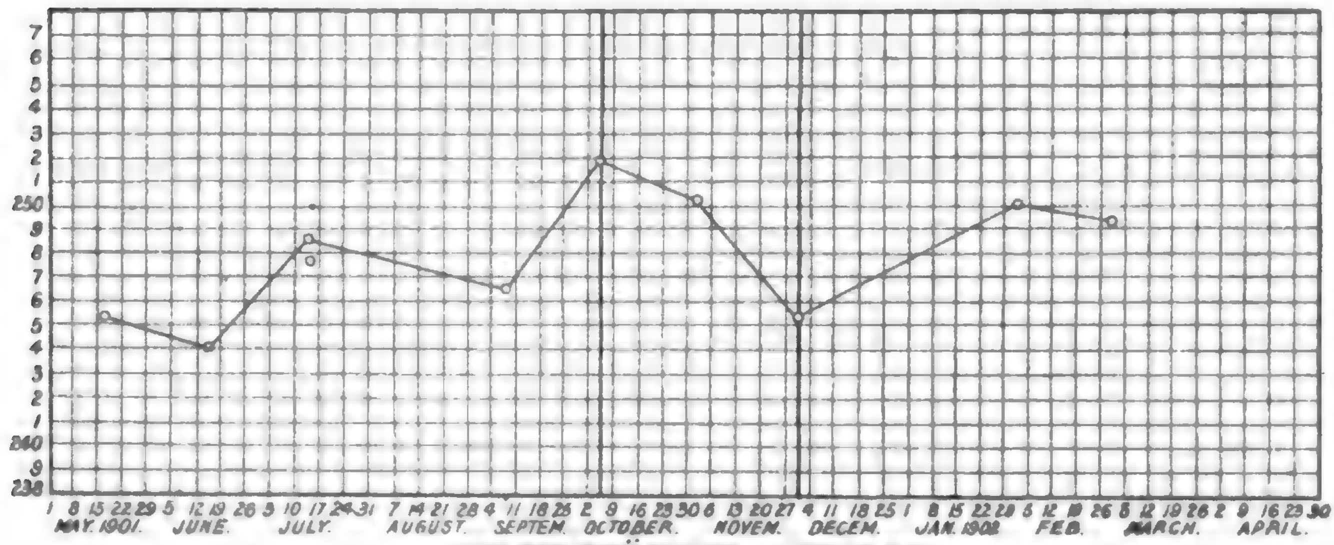
COWS OUTSIDE *Special fodder, Cottonseed meal*	COWS OUT IN DAY IN AT NIGHT *Special fodder hay chaff & cotton seed meal*	COWS INSIDE. *Special fodder, hay, straw, carrots, bean meal, D.C.S. meal.*



REICHERT WOLLNY FIGURE.



SPECIFIC GRAVITY AT 100° F.



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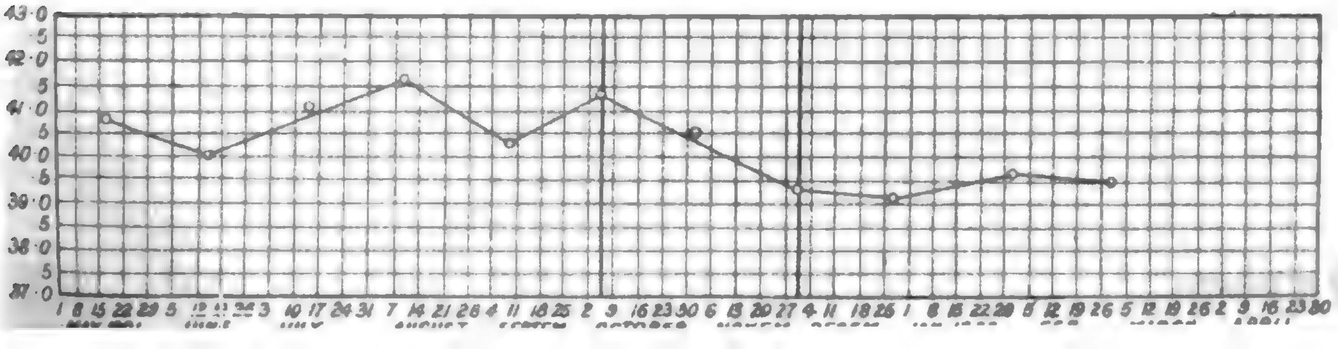


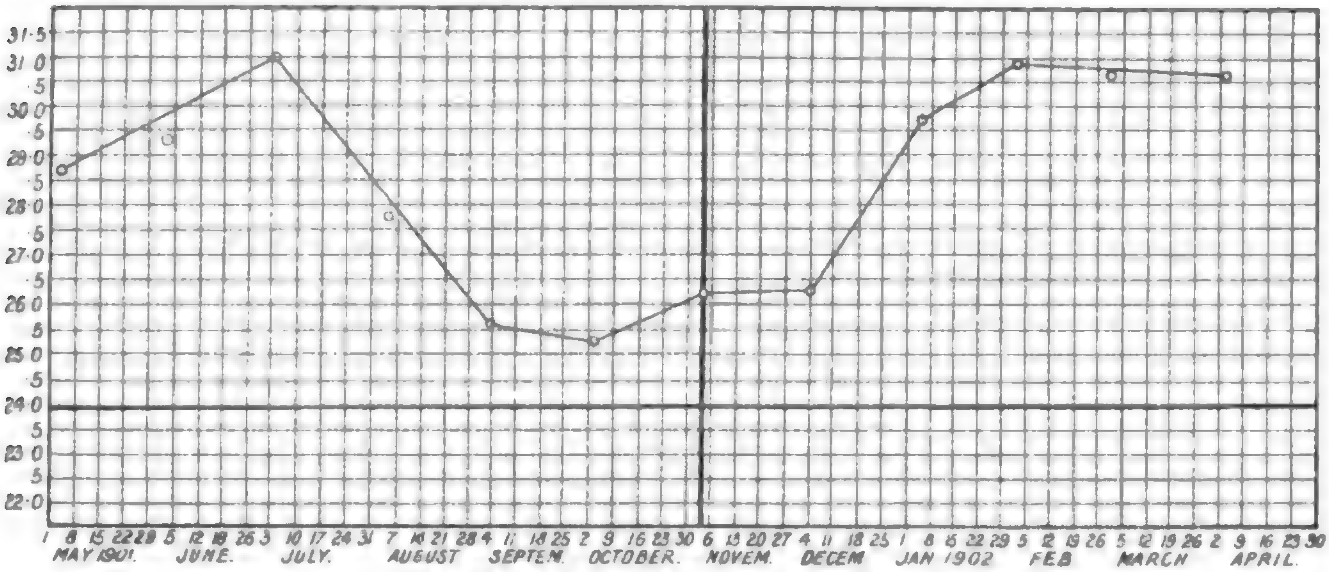
15. DUNRAGIT, UNITED CREAMERIES.

Breed of Cows: *Ayrshire.*

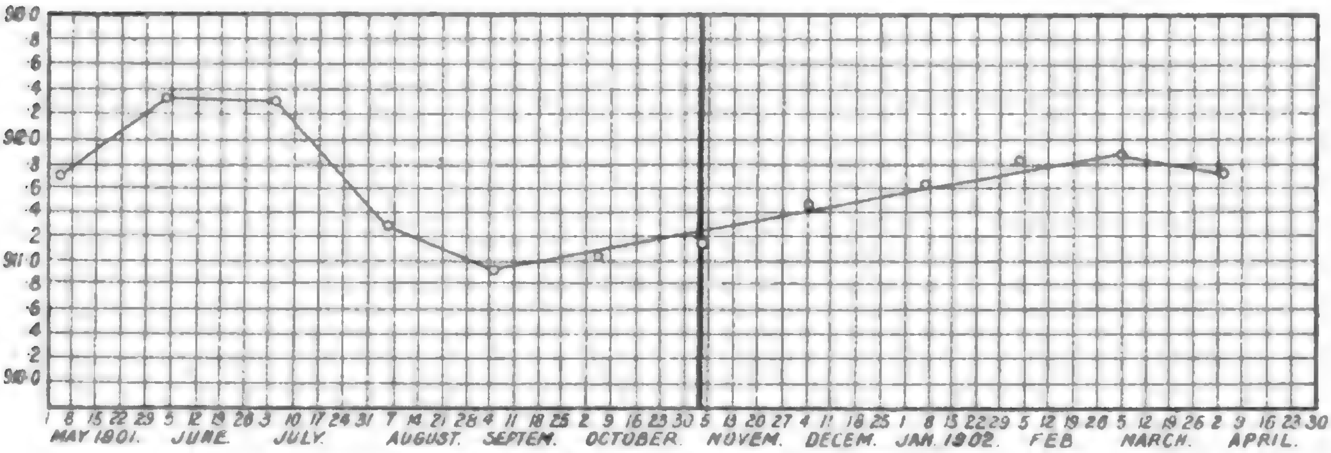
Number of Cows: *The butter was made from the mixed milk of a large herd of cattle consisting of from 400 to 1700 head.*

Lactation Period: *Six mths. to 1 mth.*

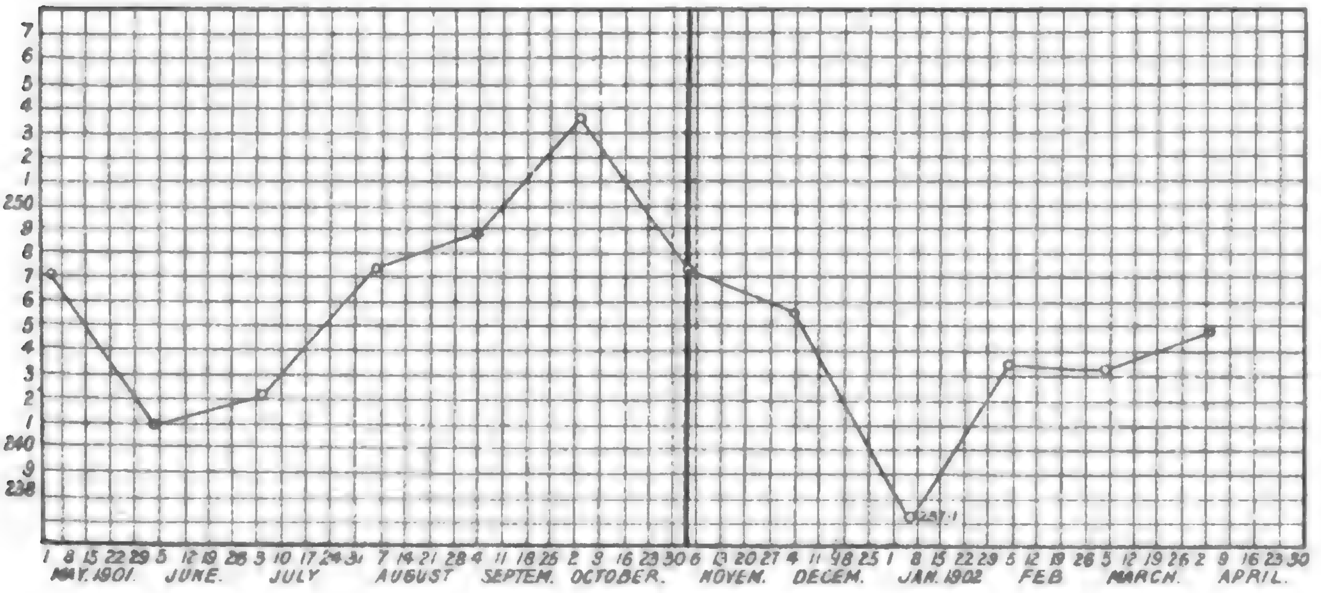
COWS OUTSIDE.	COWS INSIDE. *Special fodder, straw, turnips, cotton cake, bean meal & dried grains.*



REICHERT WOLLNY FIGURE.



SPECIFIC GRAVITY AT 100° F.



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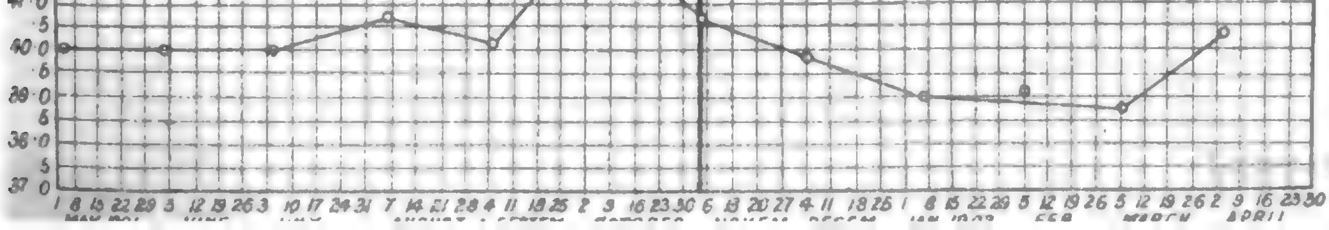
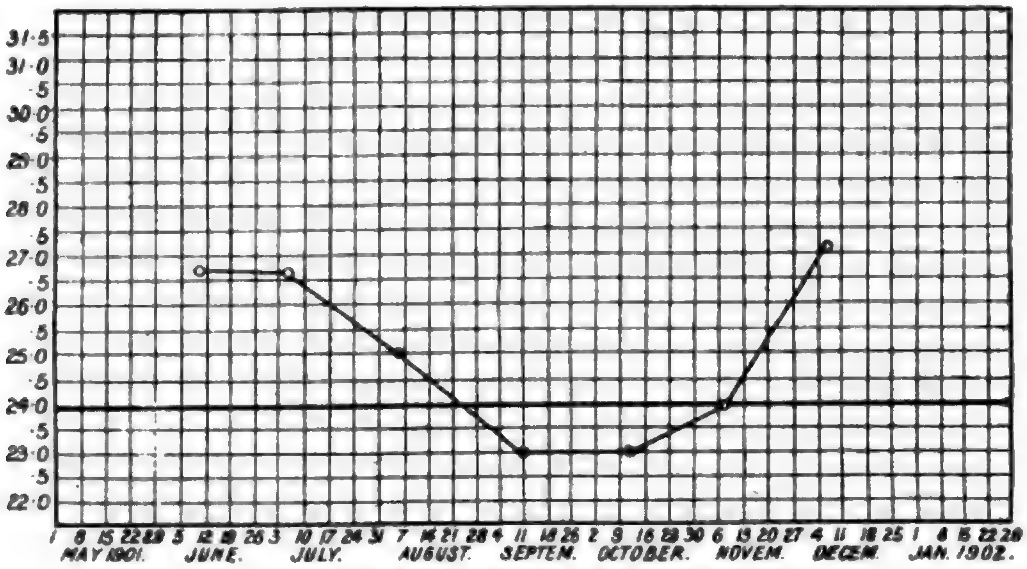


10. NEWTON FARM, GLASGOW.

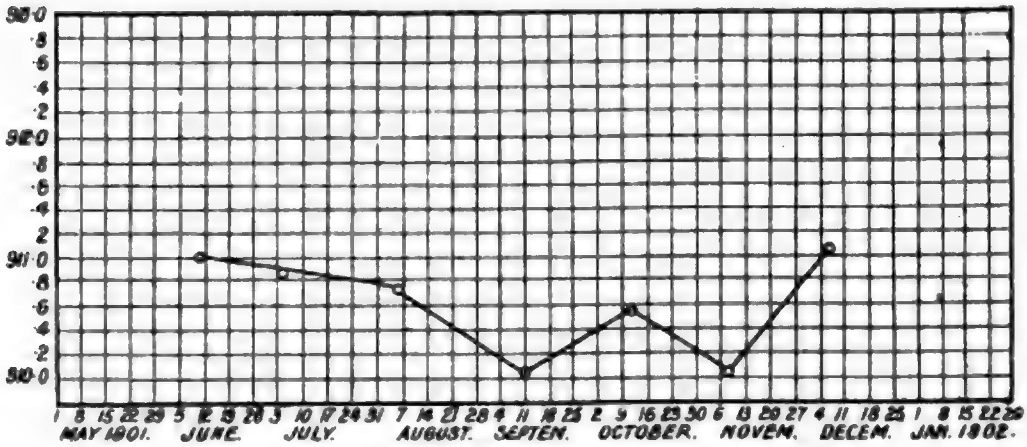
Breed of Cows: *Ayrshire.*
Number of Cows. *5*
Lactation Period: *2 - 3 mths in June. In Nov: the Government Laboratory was informed that "the cows may be dry one month hence." In Dec: "three cows are dry; two more will be so in a month's time."*

COWS OUTSIDE *during the whole period.*

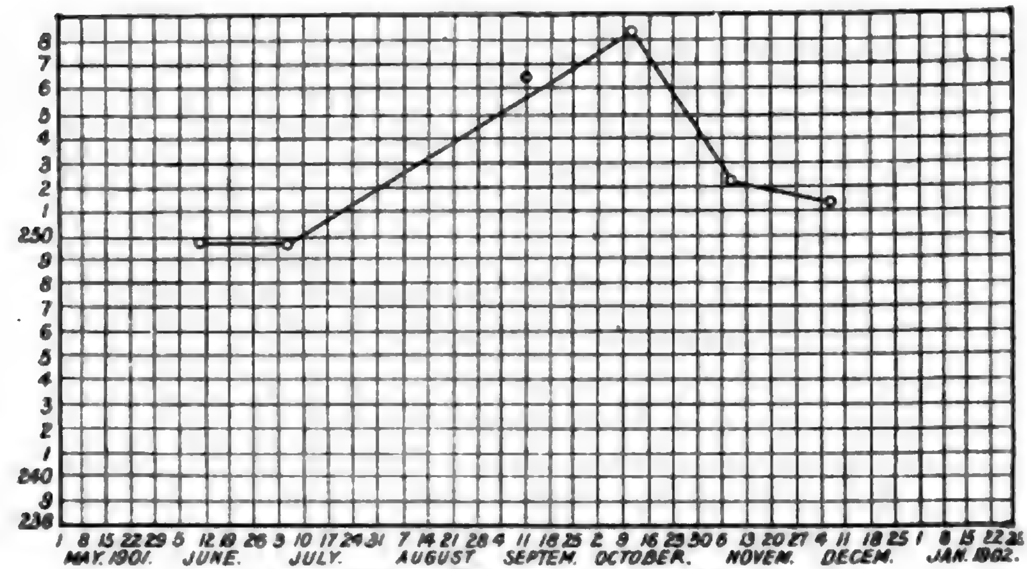
Special fodder, cotton seed meal, grains, chaff & sewage grass until the end of Aug.. Afterwards, cotton seed meal, rice meal, chaff & cabbages for a month. After then, carrot leaves & clover were included.



REICHERT WOLLNY FIGURE.



SPECIFIC GRAVITY AT 100° F.



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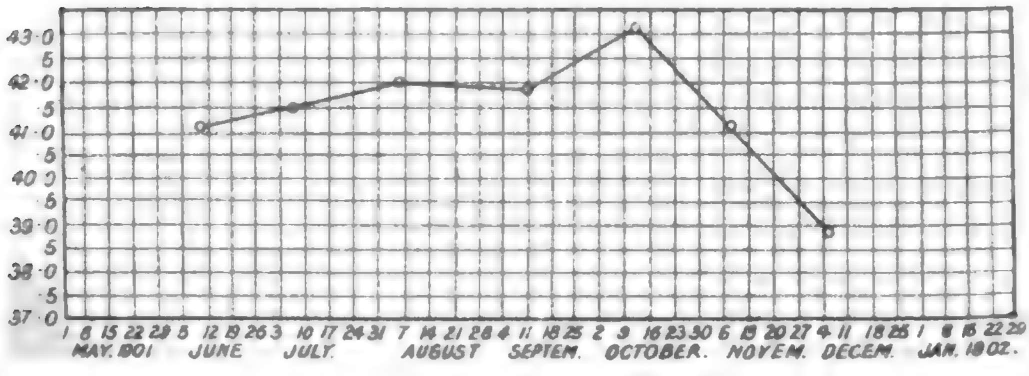
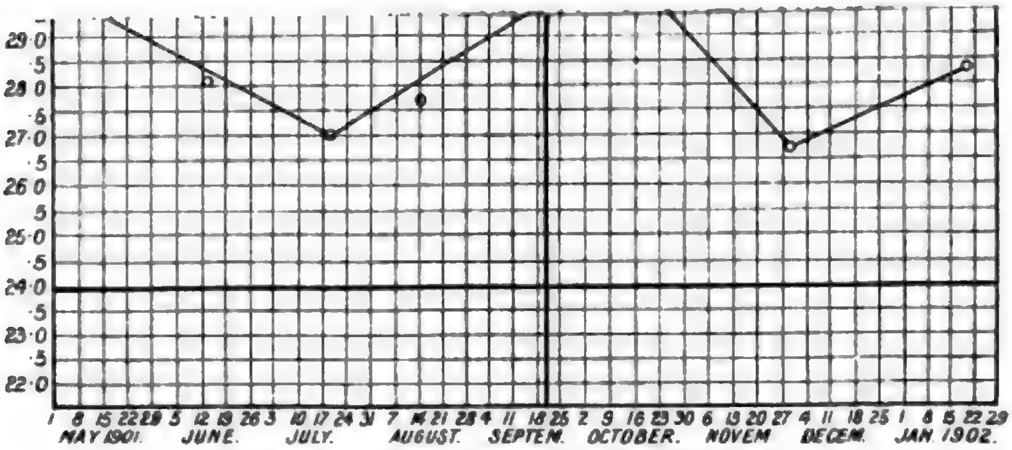
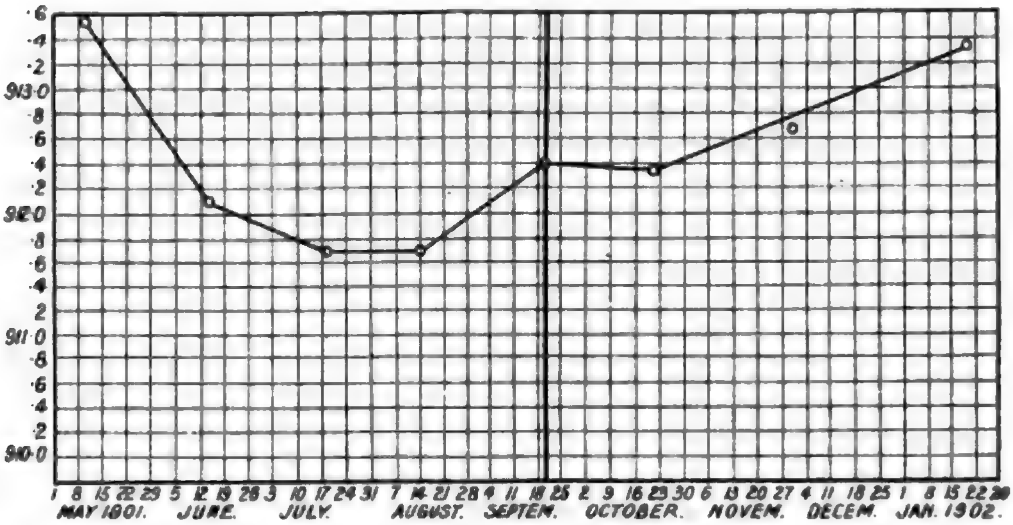


20 . SHINNESS, LAIRG, SUTHERLAND.

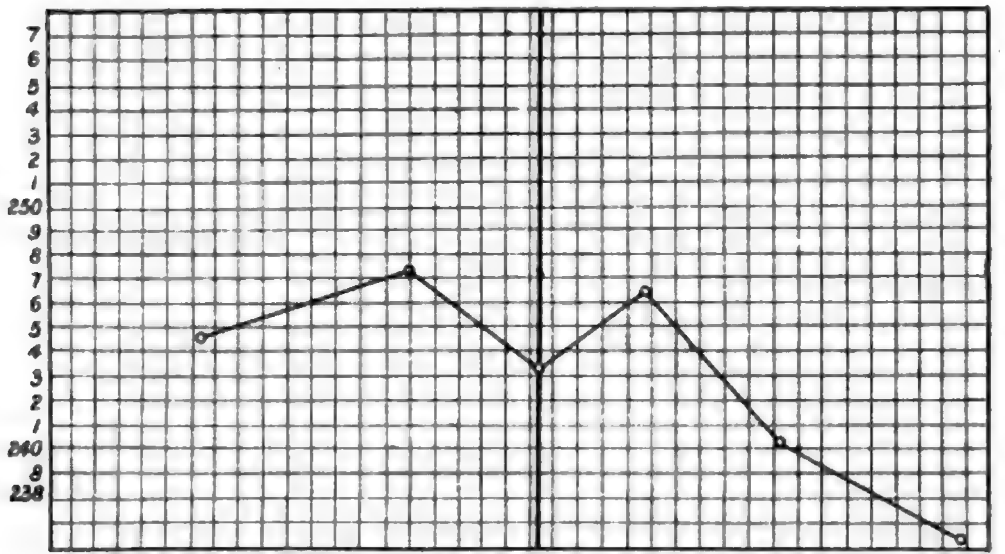
Breed of Cows: *Crossbred.*



REICHERT WOLLNY FIGURE.



SPECIFIC GRAVITY AT 100° F.



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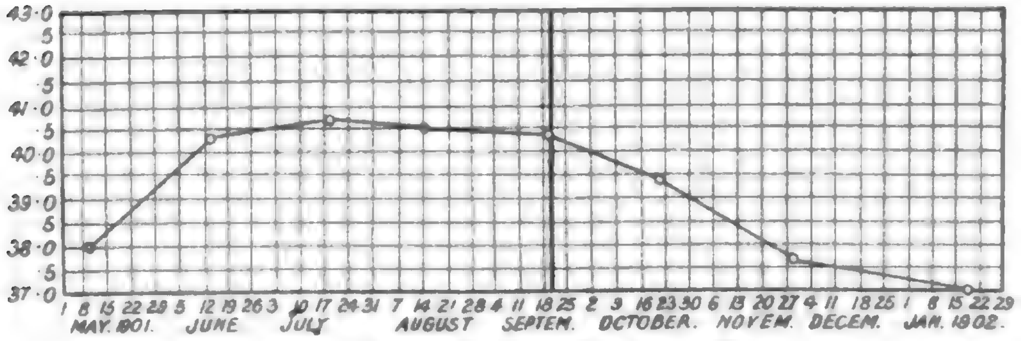
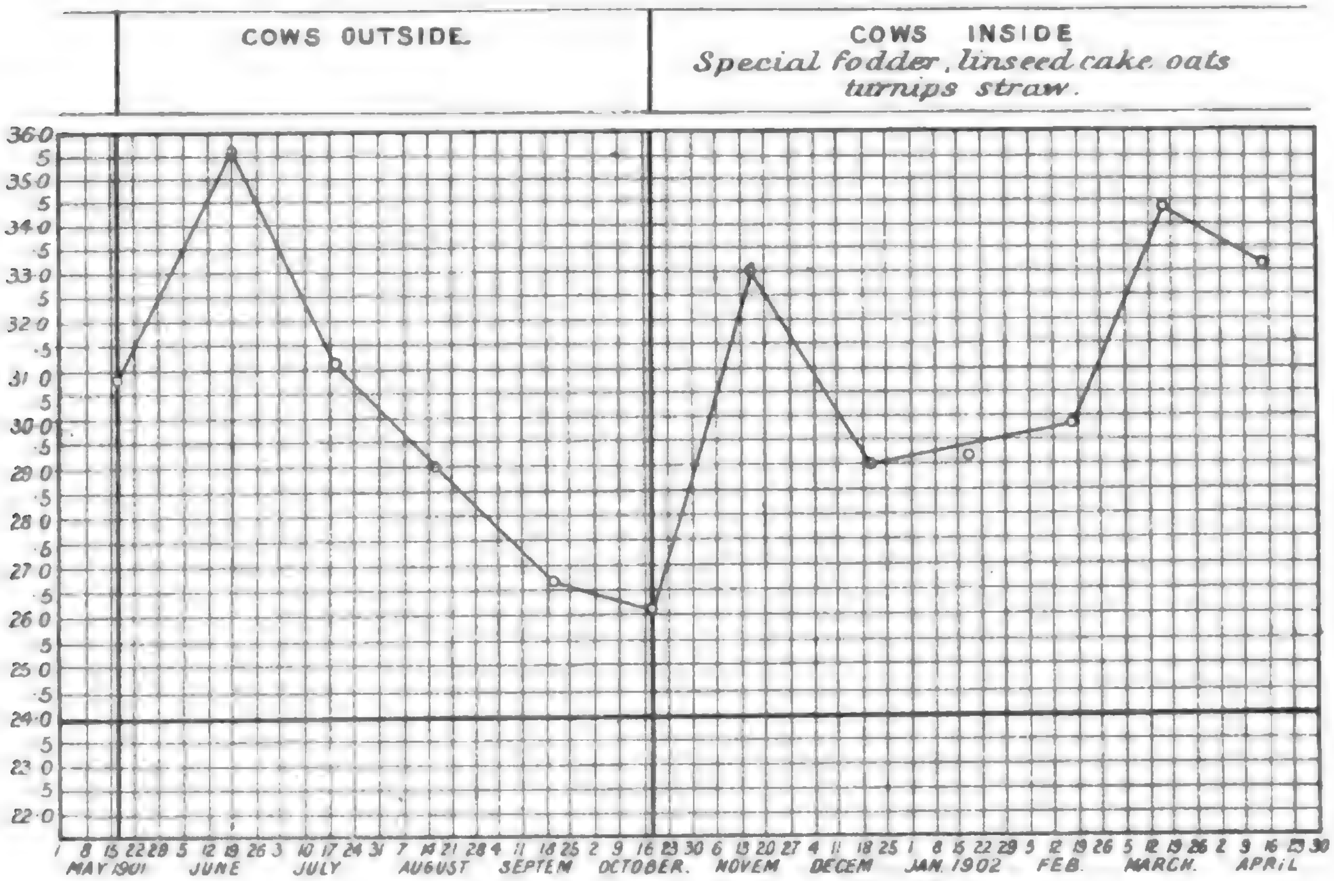


ZEISS FIGURE AT 45° C.

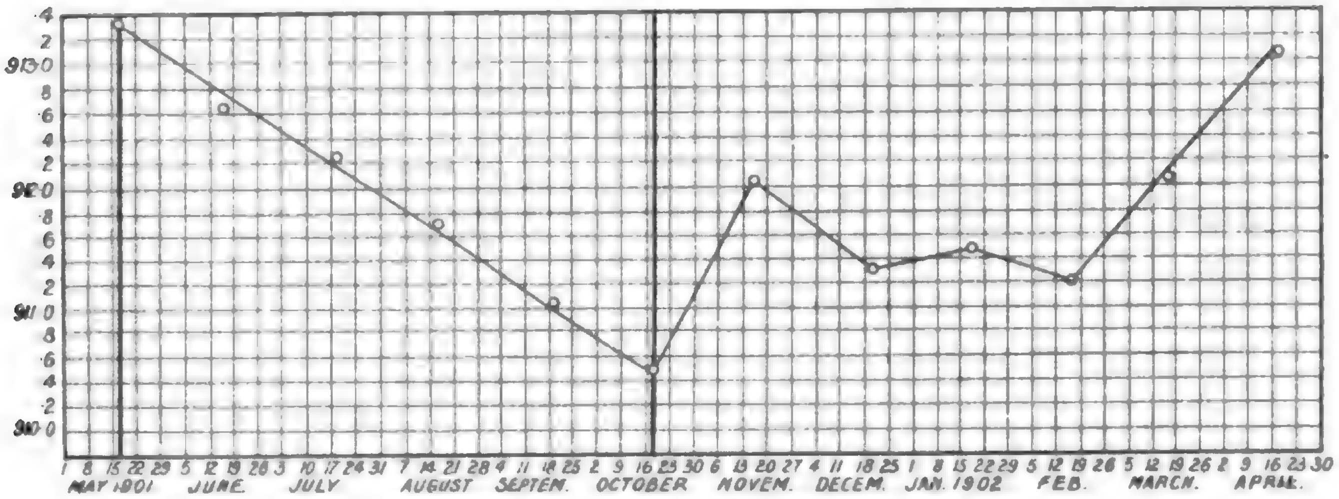
20 . SHINNESS, LAIRG, SUTHERLAND.

Breed of Cows: *Crossbred.*

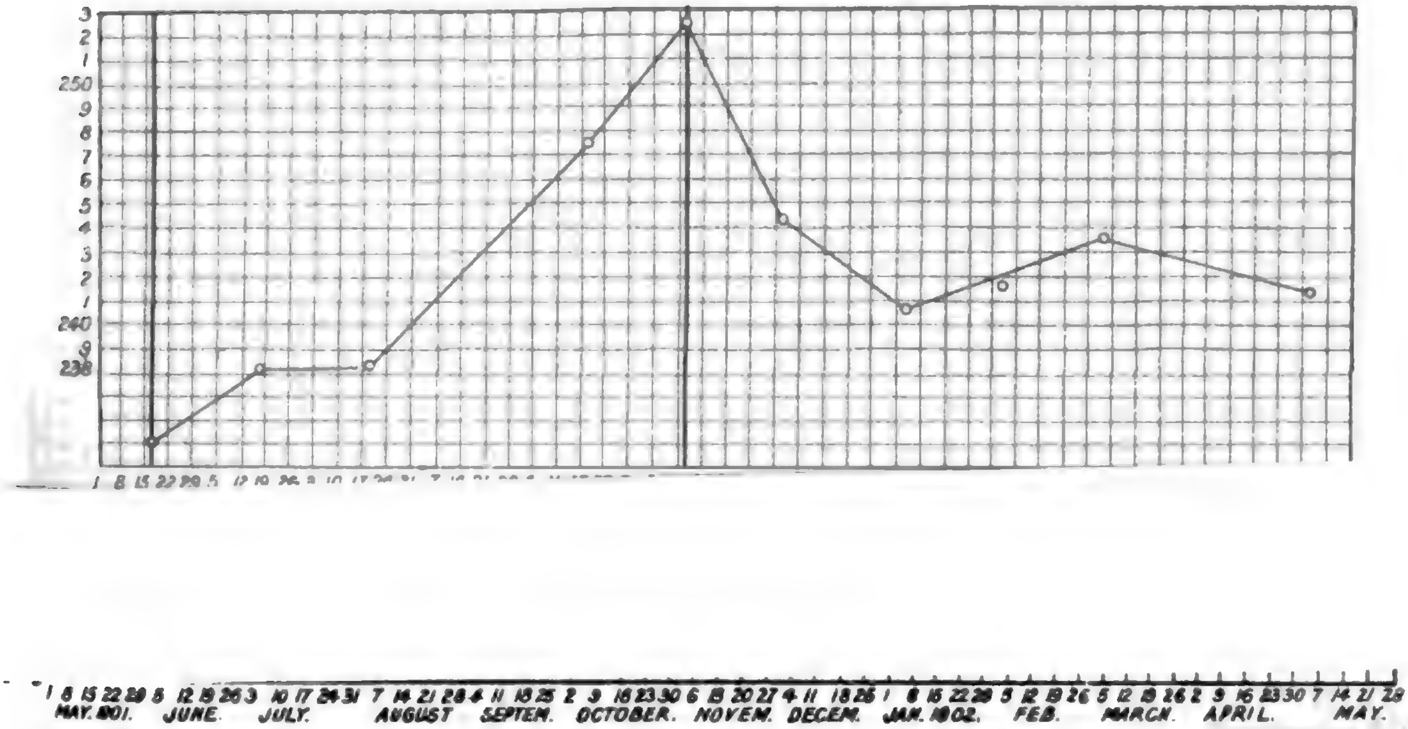
Feb. 7 to 1 mth., March 1 for 8 mths., 1 for 4 mths., 1 for 1 mth. 1 for 2 weeks; April 5 mths. to 2 weeks.



REICHERT WOLLNY FIGURE.



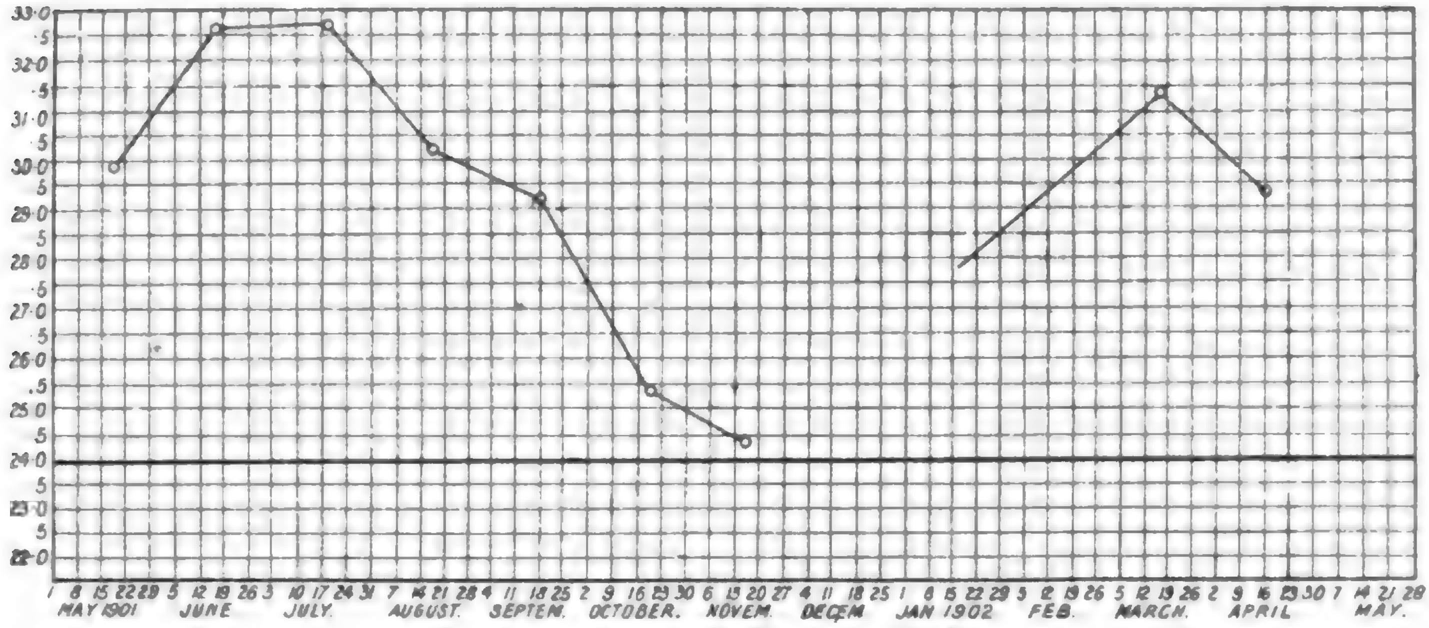
SPECIFIC GRAVITY AT 100° F.



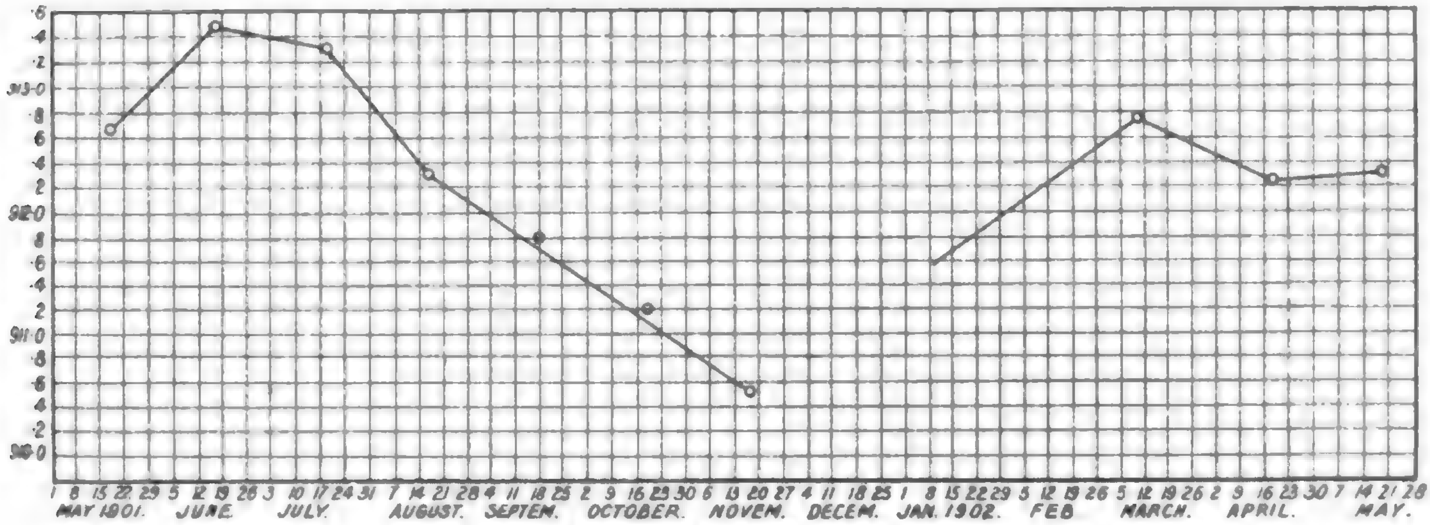
ZEISS FIGURE AT 45°C.

20. SHINNESS, LAIRG, SUTHERLAND.

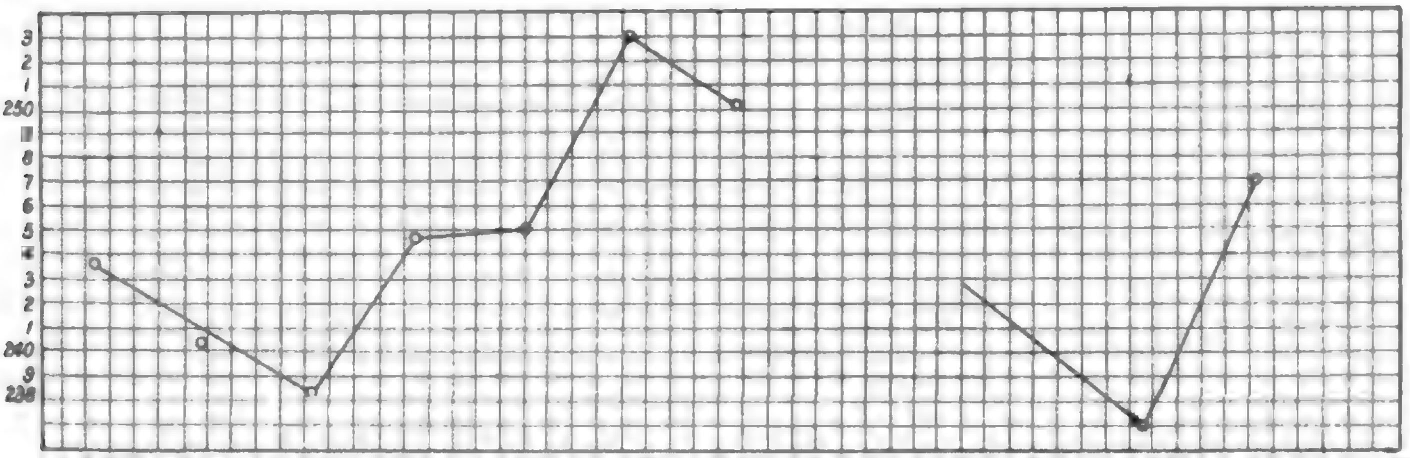
Breed of Cows: *Crossbred.*
Number of Cows: *2.*
Lactation Period: *In May 1 for 3 mths. & 1 for 2 mths. Add 1 mth. at each sampling till March. March both six weeks; April both 10 weeks; May both 14 weeks.*



REICHERT-WOLLNY FIGURE.



SPECIFIC GRAVITY AT 100° F.



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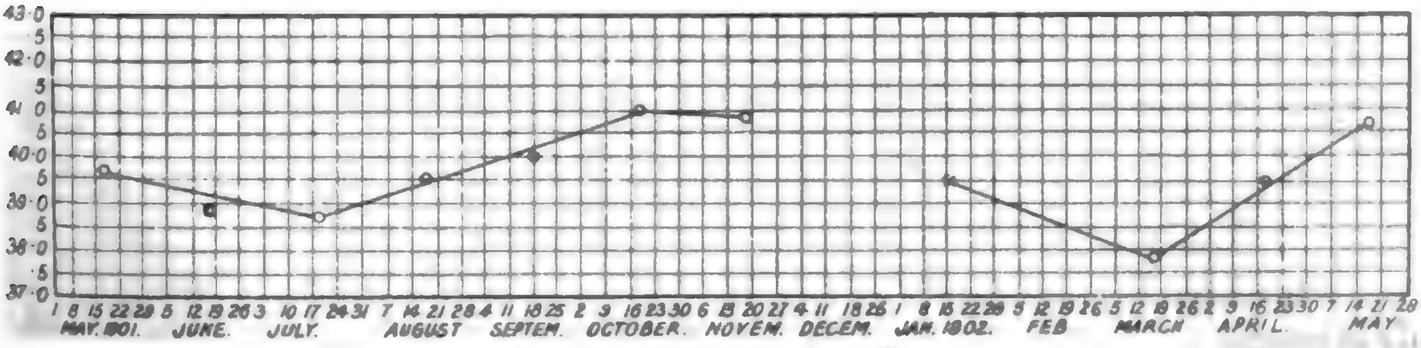
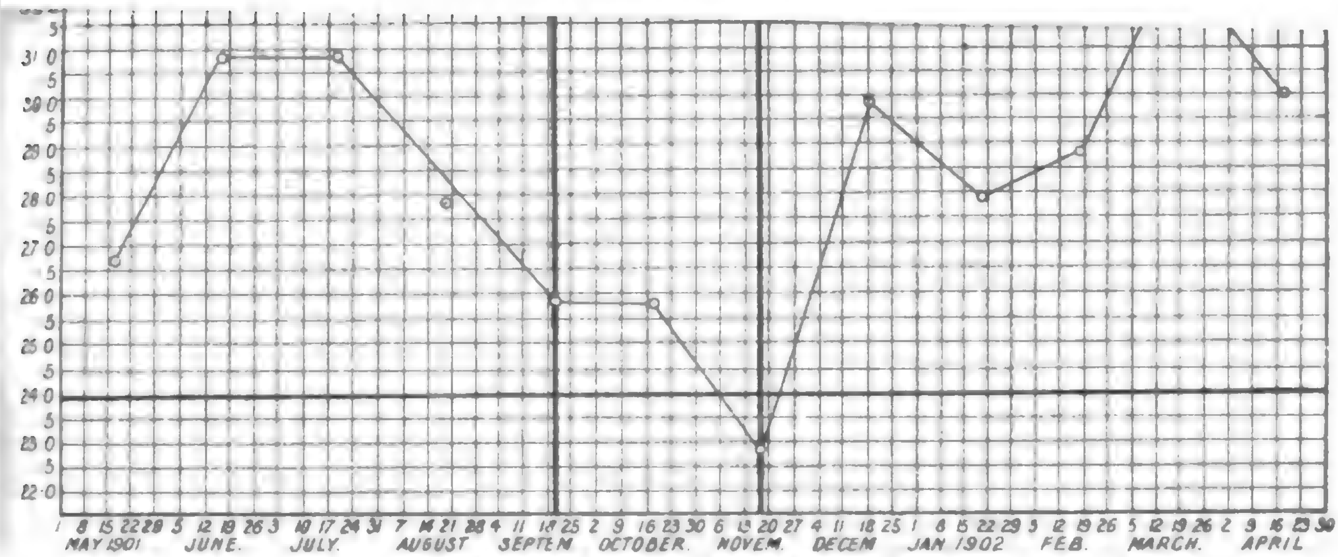


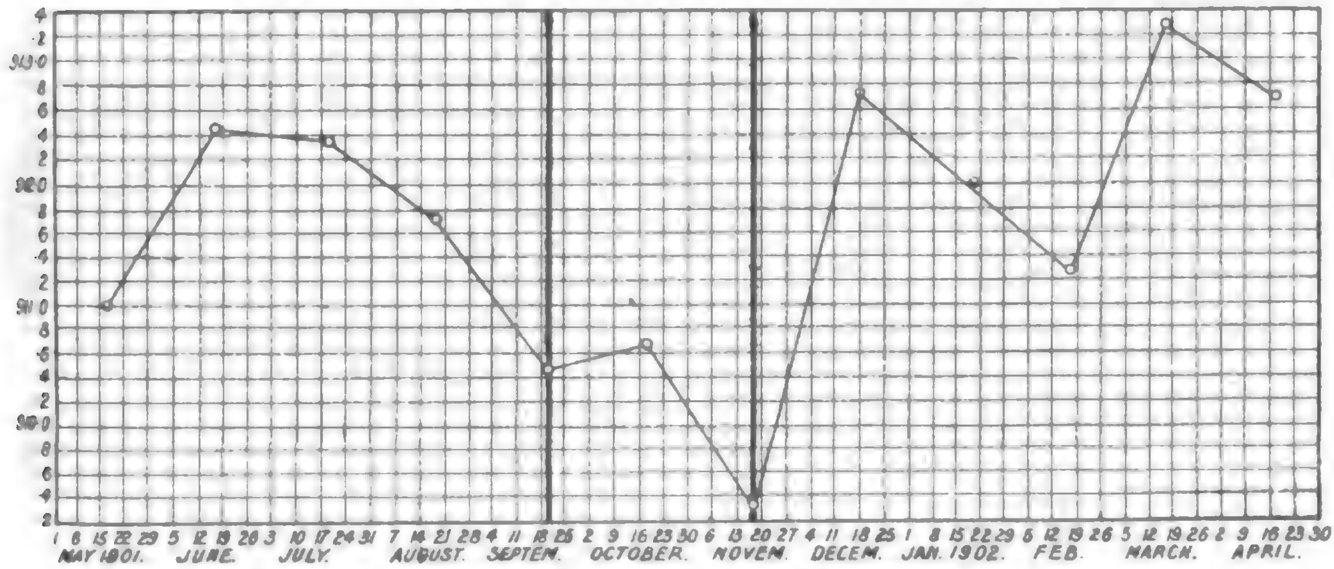
ZEISS FIGURE AT 45° C.

22. SANDAY FARM, ORKNEY ISLANDS.

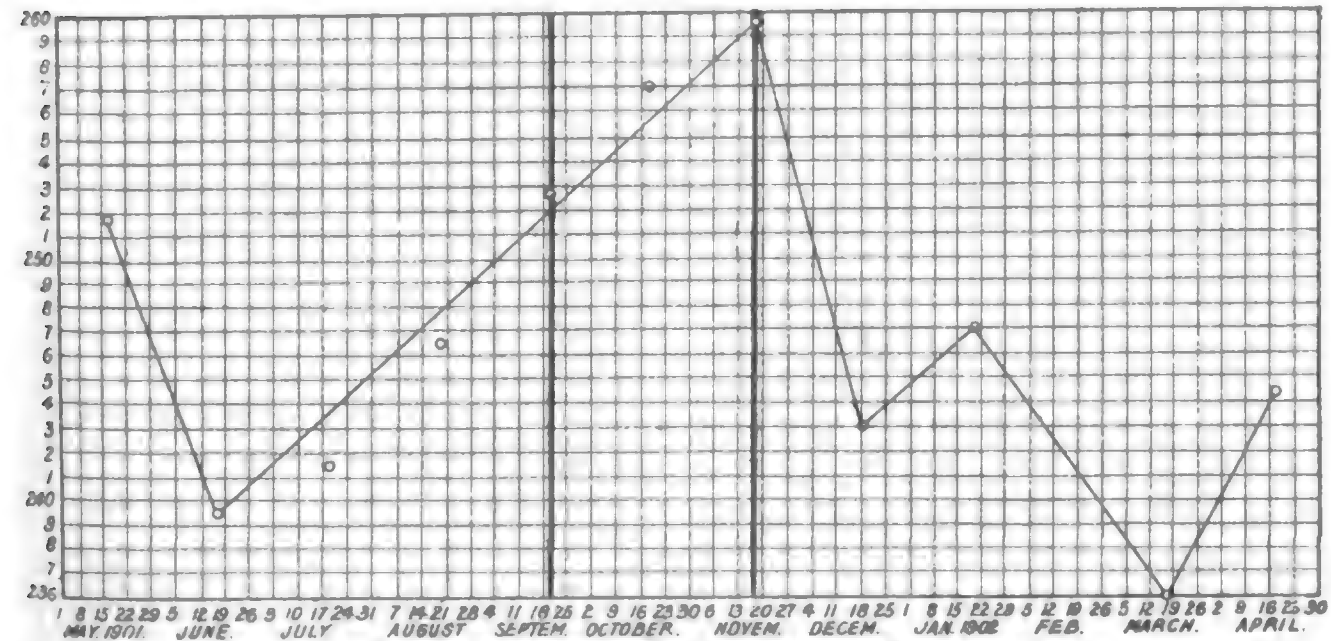
Breed of Cows: Crossbred



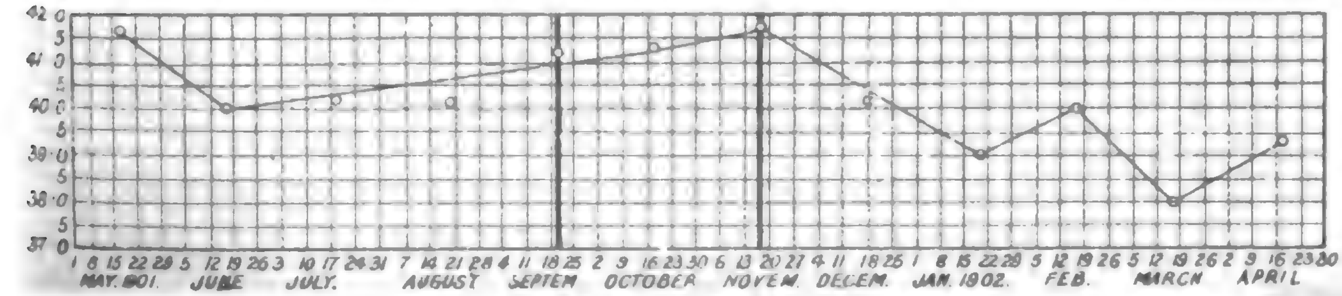
REICHERT-WOLLNY FIGURE.



SPECIFIC GRAVITY AT 100° F.



KOETTSTÖRFER NUMBER.



ZEISS FIGURE AT 45°C.

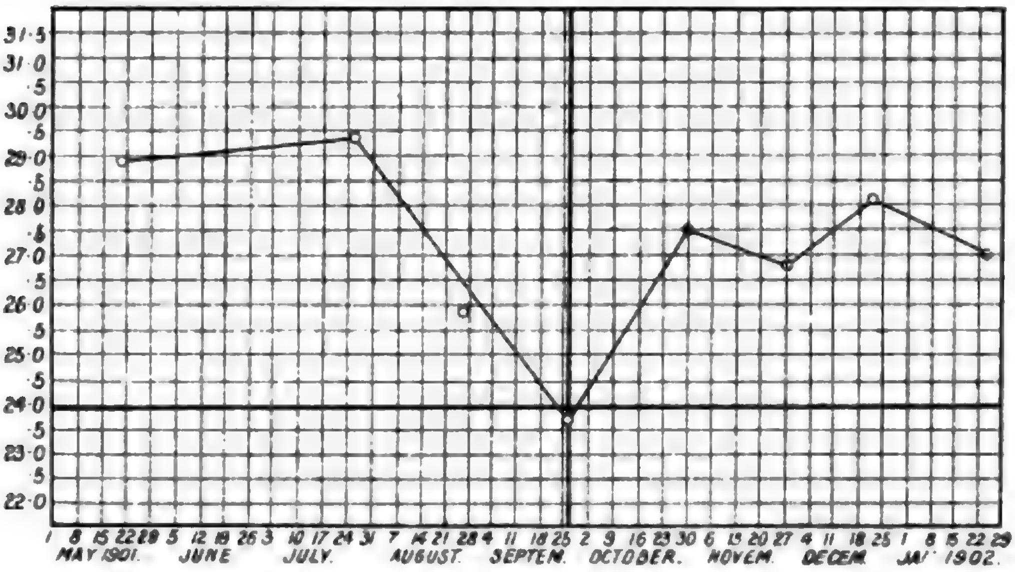
22. SANDAY FARM, ORKNEY ISLANDS.

BREED OF COWS: *Crossbred.*

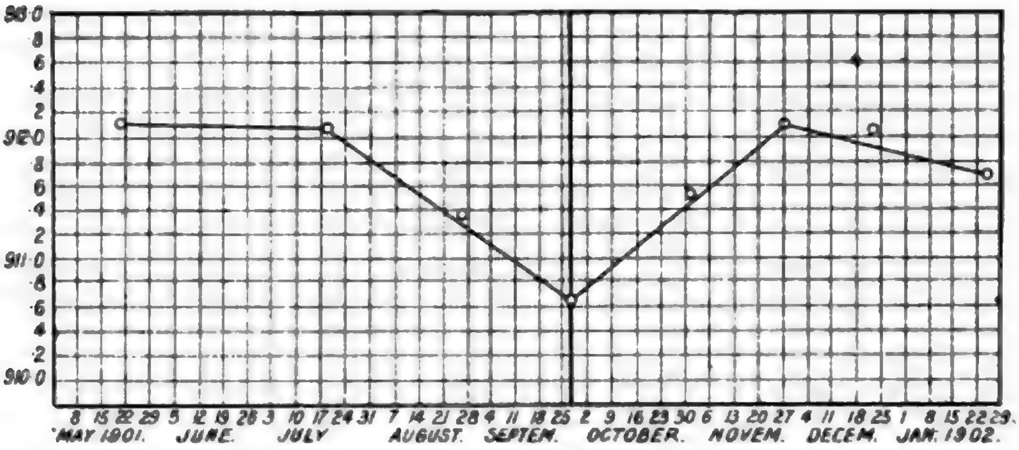
NUMBER OF COWS: *13 till Sept. 9 afterwards.*

LACTATION PERIOD: *6 to 1 mths. in May; 7 to 2 mths. in July; 8 to 3 mths. in Aug; 10 to 2 mths. in Sept., 6 cows taken from herd dry; 12 to 1 mths. in Oct; 12 to 1 mths. in Dec.*

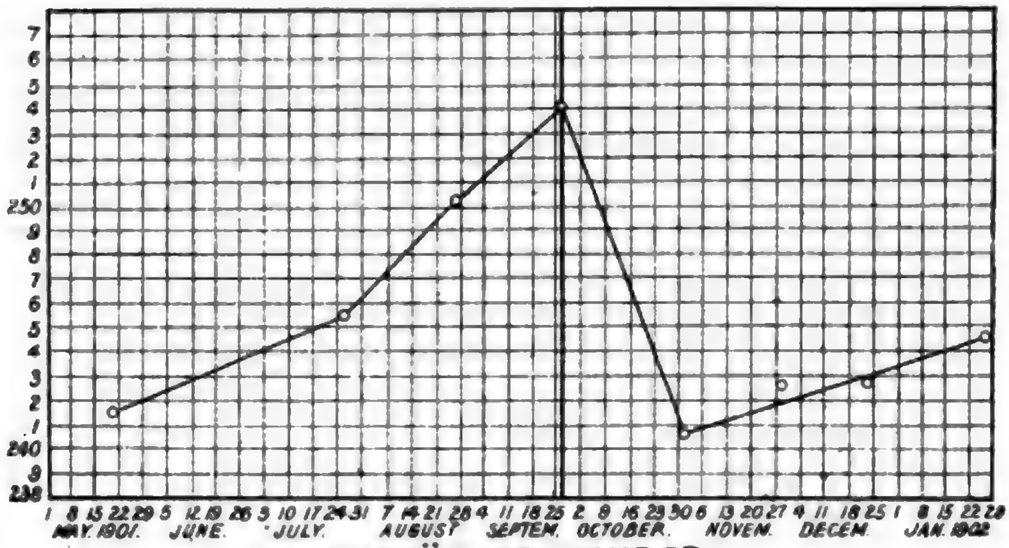
COWS OUTSIDE	COWS INSIDE
In July, ripe clover, cocksfoot and natural grass; excessively hot weather, no rain for 6wks. *In Aug. no special fodder, cold and wet weather.* *In Sept. grass taking second growth, weather wet & muggy.*	*Special fodder, turnips and straw.*



REICHERT WOLLNY FIGURE.



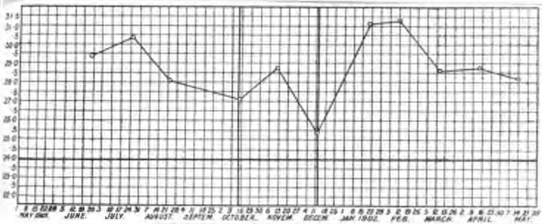
SPECIFIC GRAVITY AT 100° F.



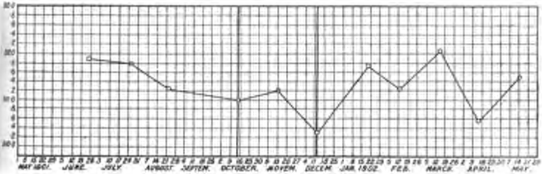
KOETTSTÖRFER NUMBER.

ZEISS FIGURE AT 45°C.

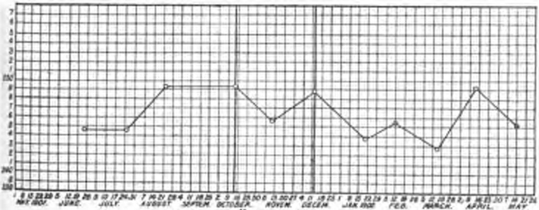
28 SUMBURGH FARM. SHETLAND ISLANDS.



REICHERT WOLLNY FIGURE.



SPECIFIC GRAVITY AT 100° F.



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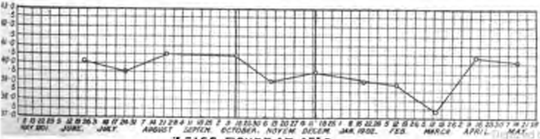
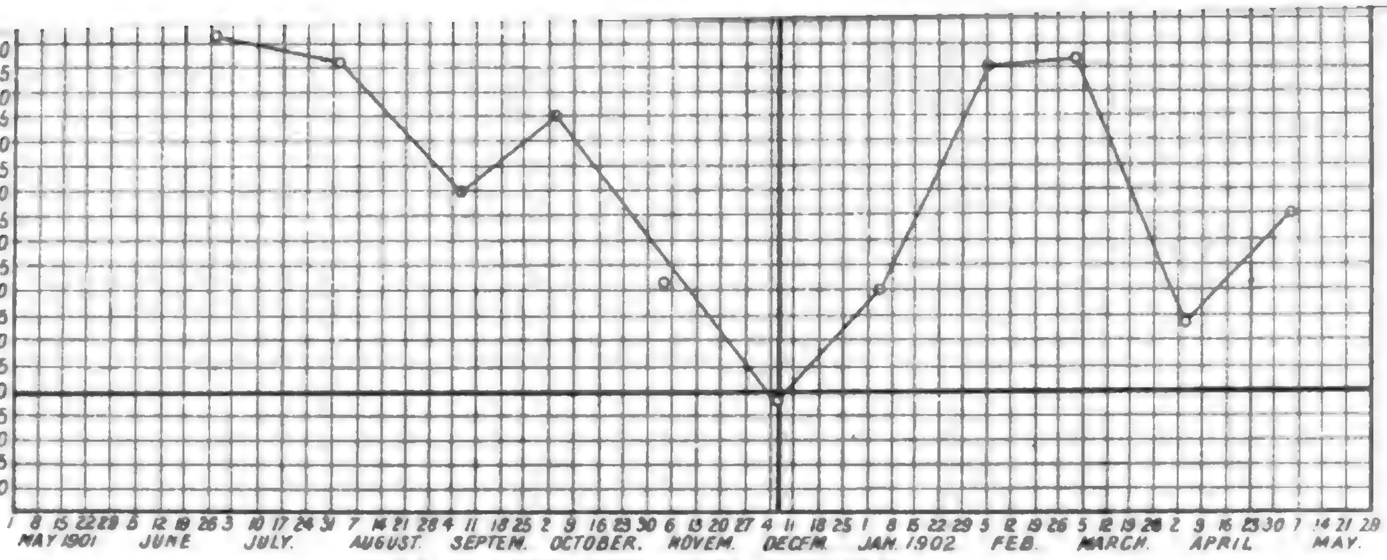
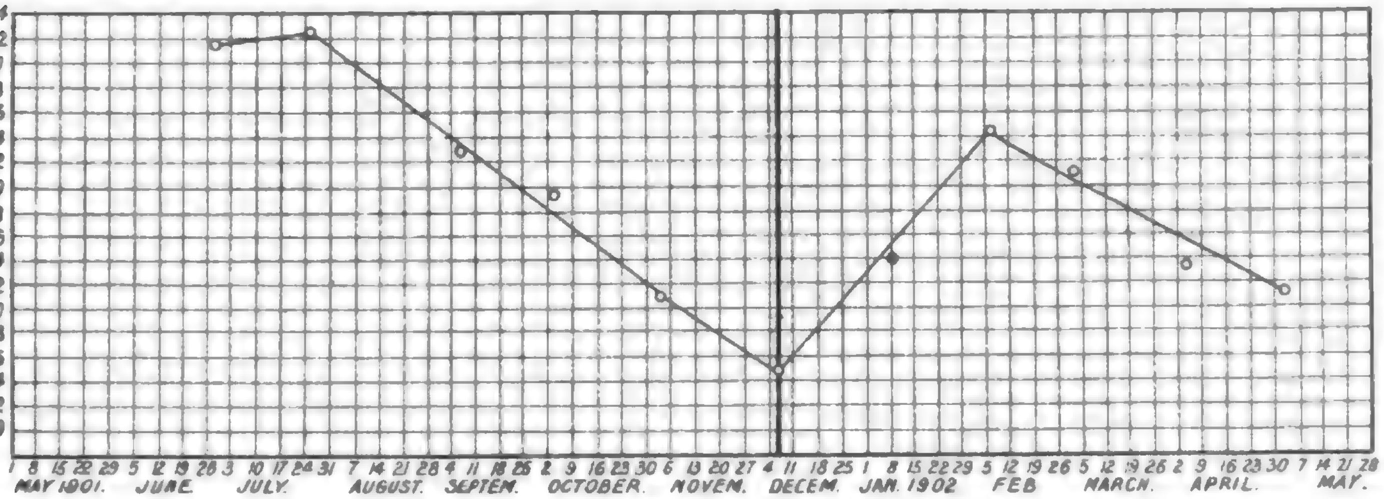


ZEISS FIGURE AT 45°C.

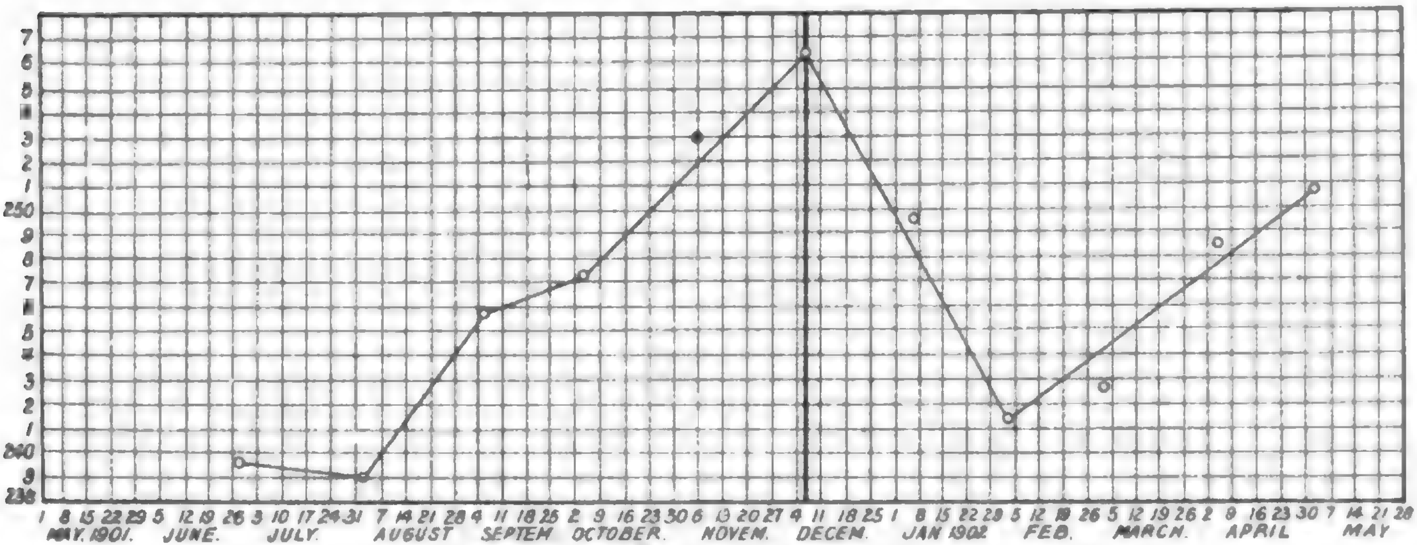
28 SUMBURGH FARM. SHETLAND ISLANDS.



REICHERT WOLLNY FIGURE.



SPECIFIC GRAVITY AT 100° F.



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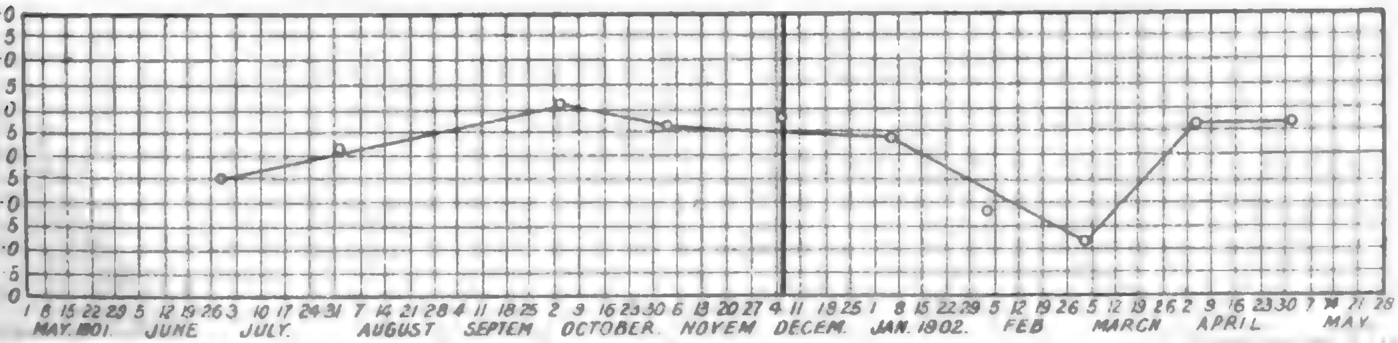
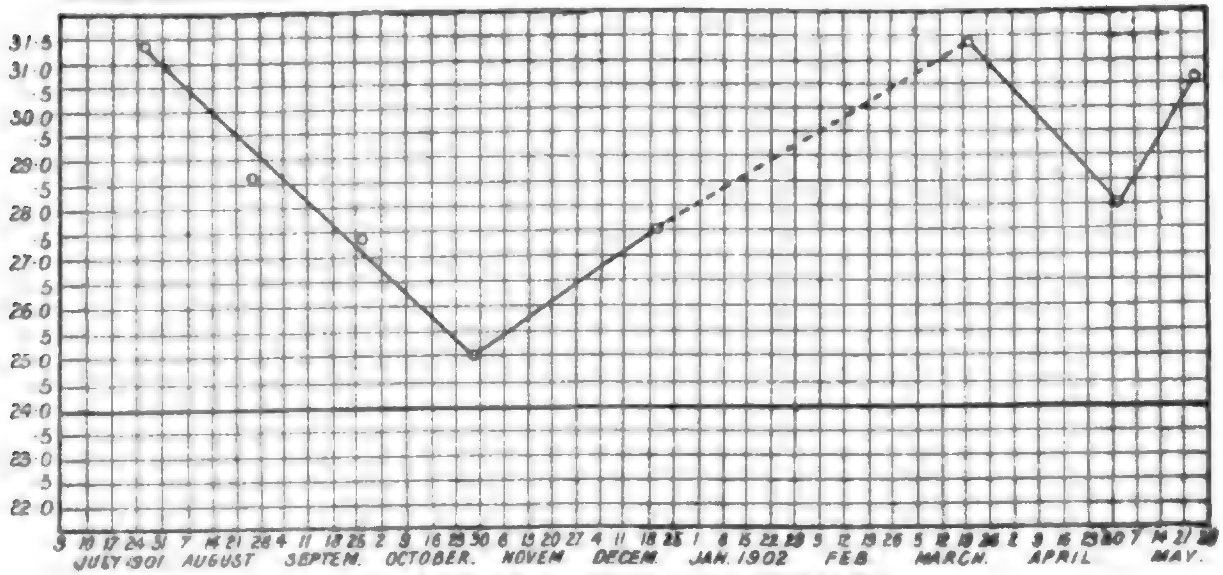


ZEISS FIGURE AT 45° C.

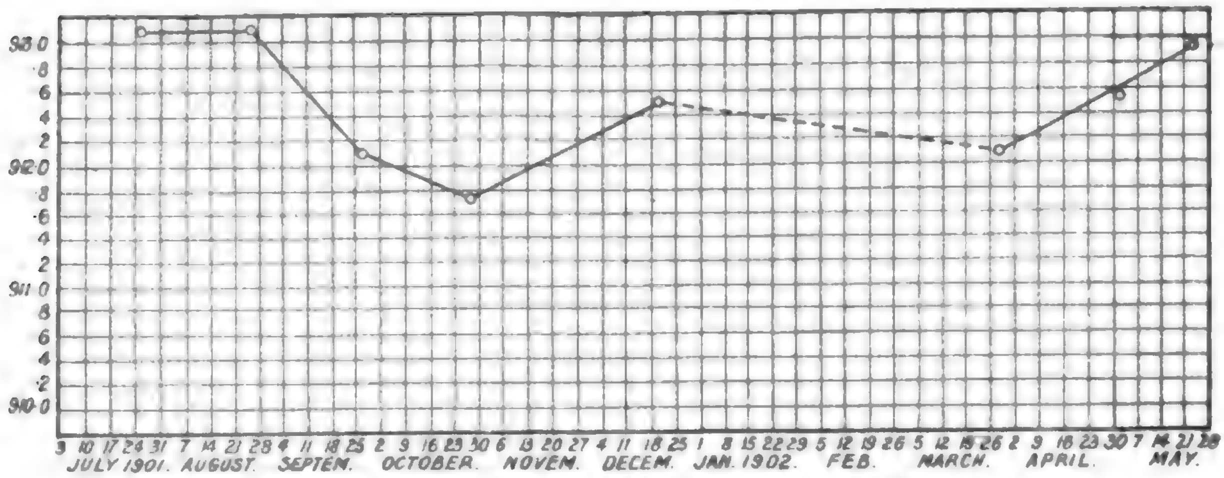
28. SUMBURGH FARM, SHETLAND ISLANDS.

BREED OF COWS. *Ayrshires & Shorthorn Crosses.*

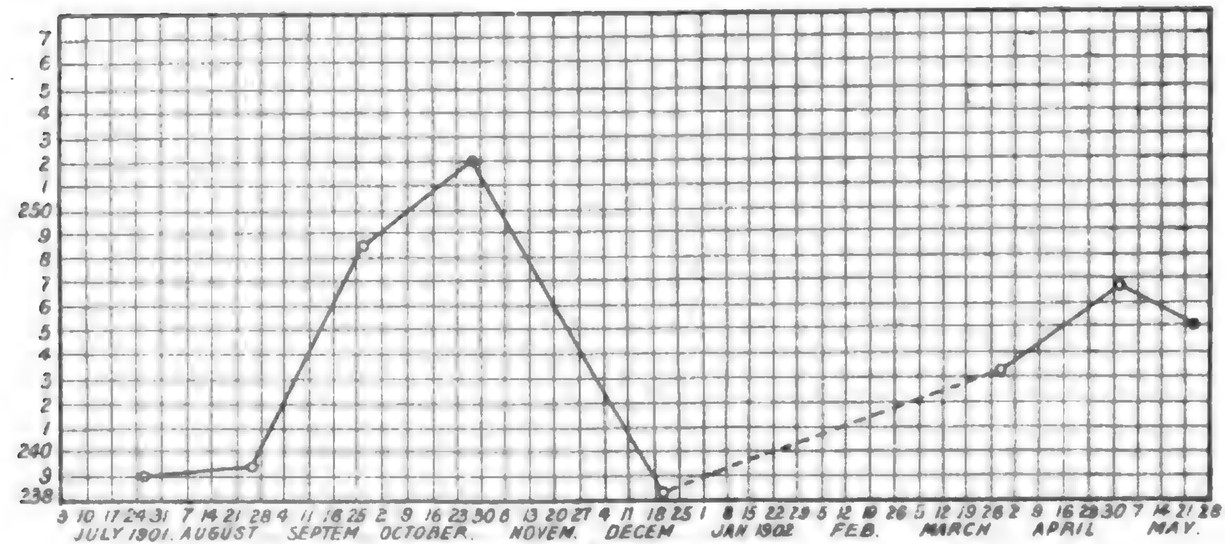
COWS OUTDOORS *until Oct., then from Oct to Dec. they were out in day-time & in at night. Till Oct. they fed on grass alone, and afterwards while in stable on straw and turnips.*



REICHERT WOLLNY FIGURE.



SPECIFIC GRAVITY AT 100° F.



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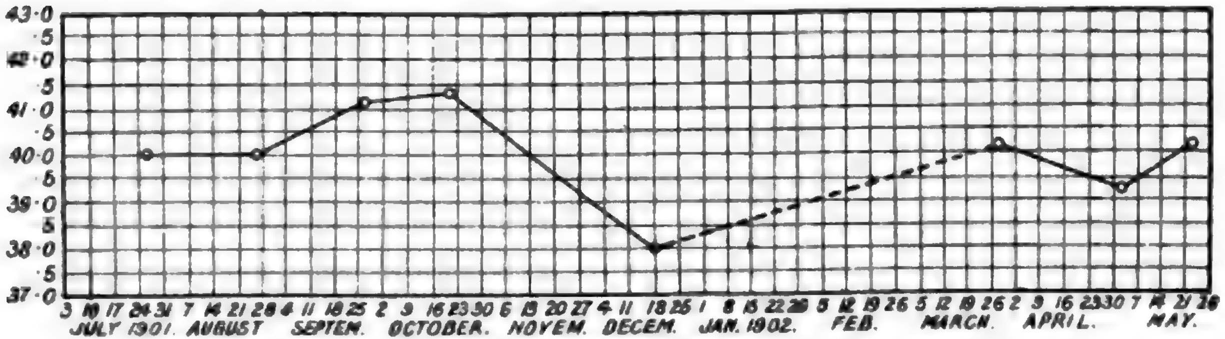
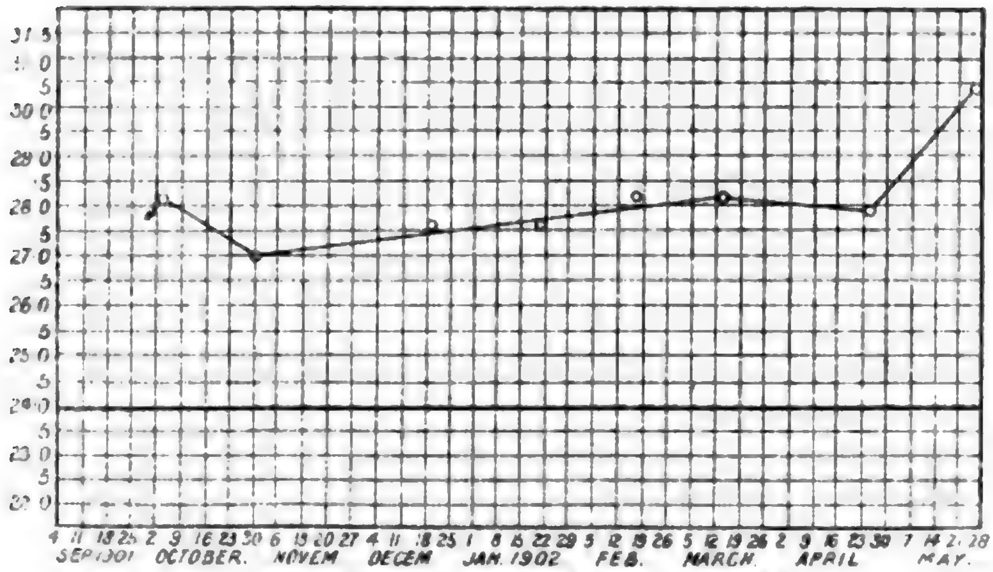


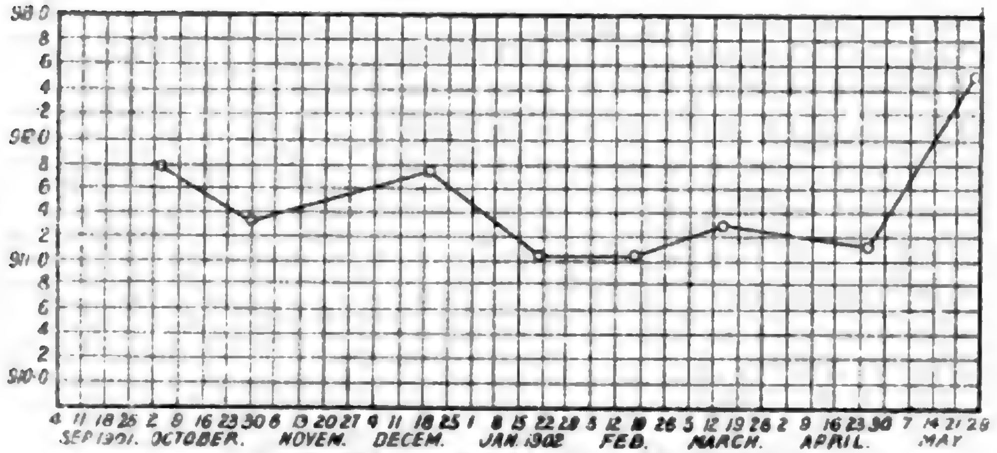
ZEISS FIGURE AT 45°C.

29. AGHADOWEY.

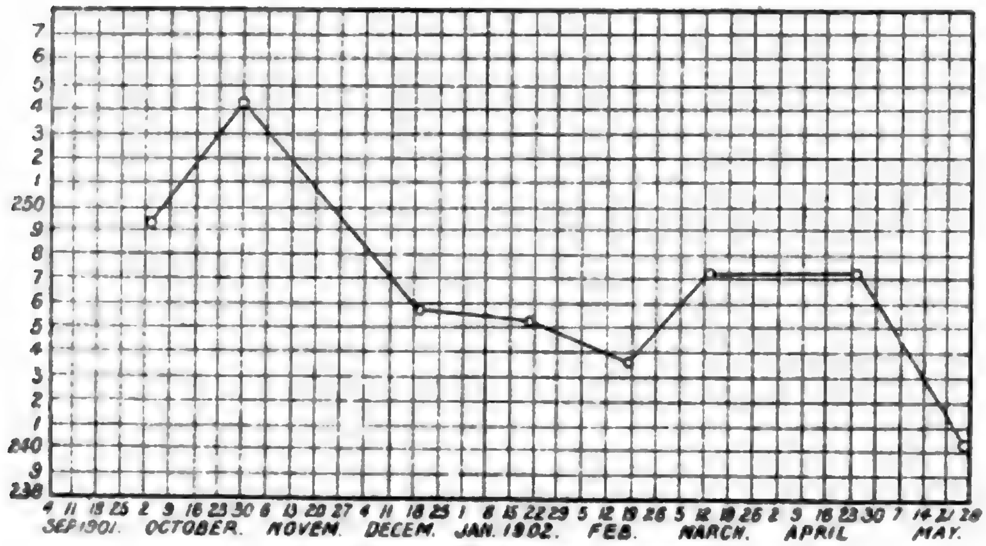
BREED OF COWS: *Crossbred.*
NUMBER OF COWS: *Large herd varying from 1000 to 1800.*



REICHERT WOLLNY FIGURE.



SPECIFIC GRAVITY AT 100° F.



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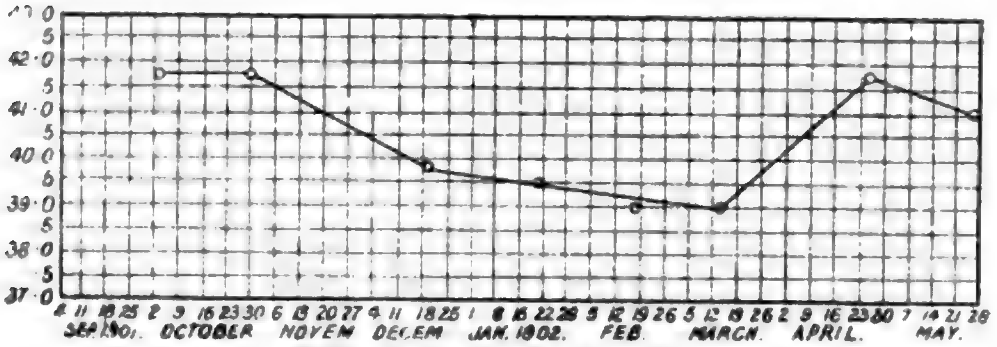
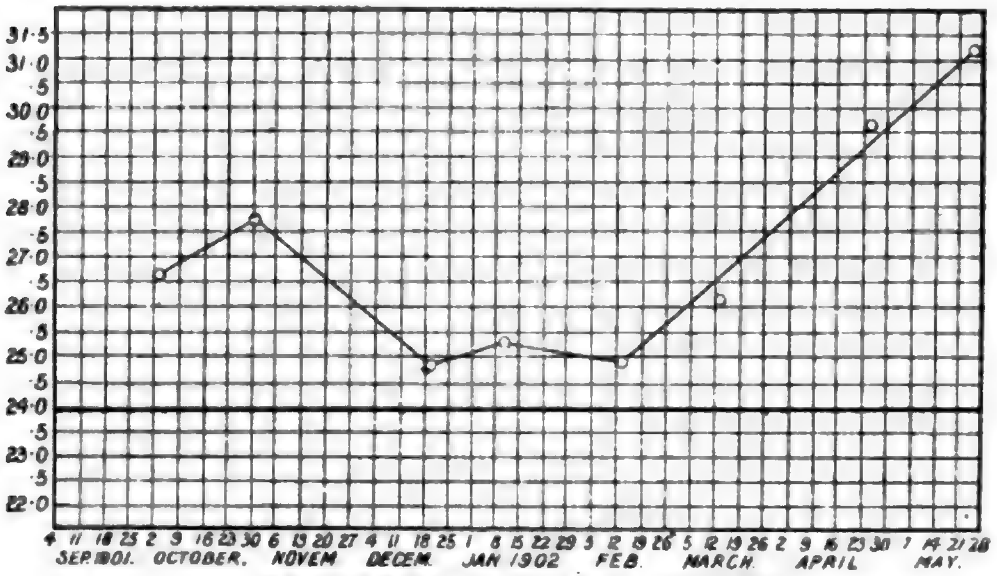


ZEISS FIGURE AT 45° C.

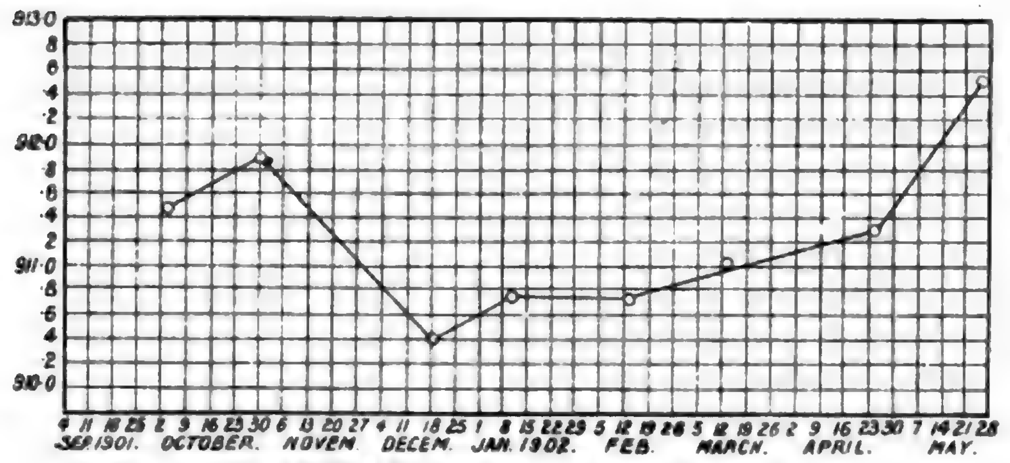
·30. SCOTTISH-WHOLESALE, INNISKILLEN.

BREED OF COWS: *Crossbred*

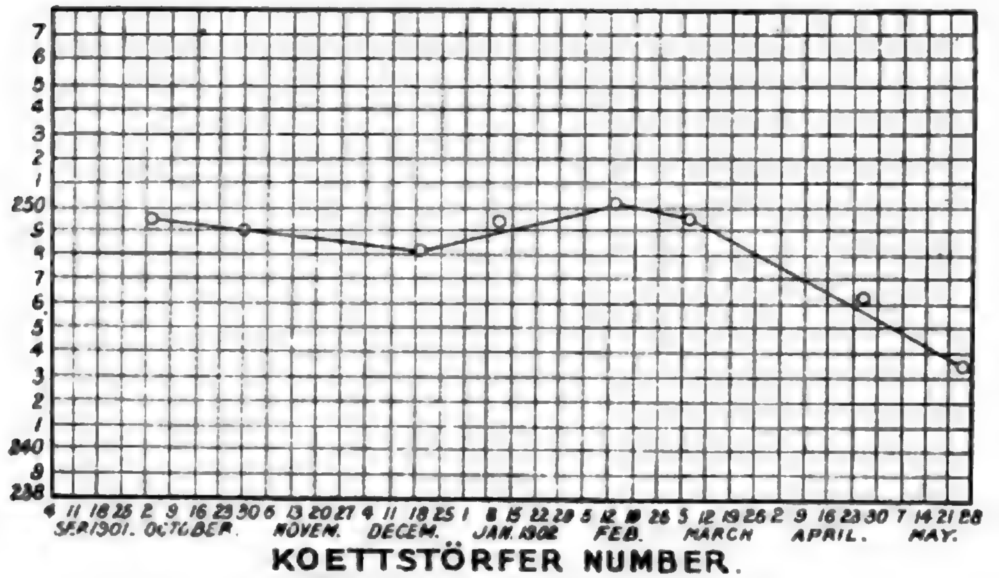
NUMBER OF COWS: *Large herd varying from 3000 to 5000.*



REICHERT WOLLNY FIGURE.



SPECIFIC GRAVITY AT 100° F.



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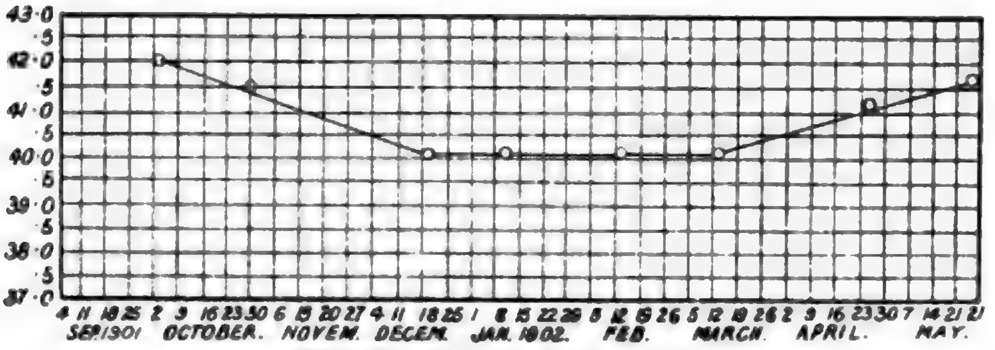
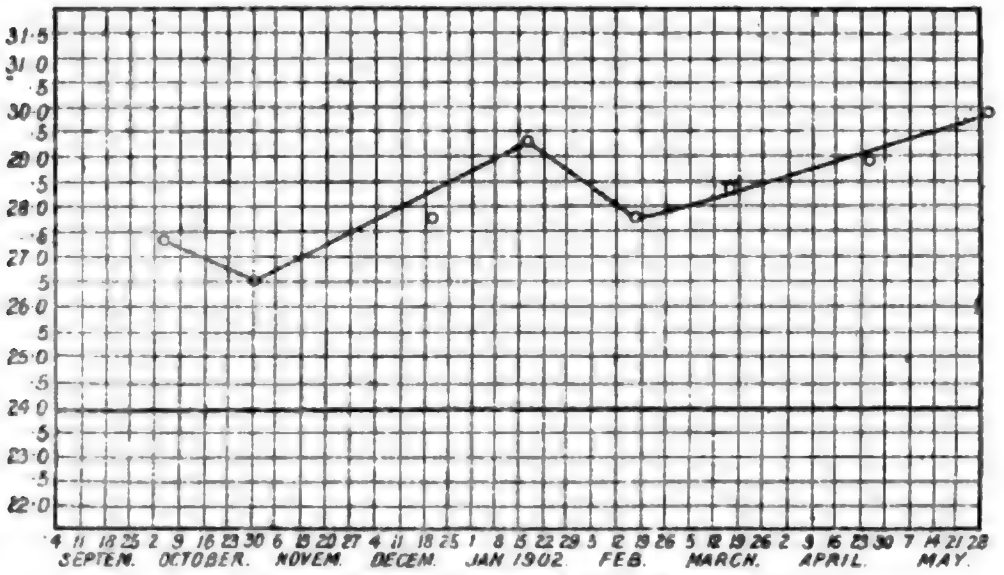


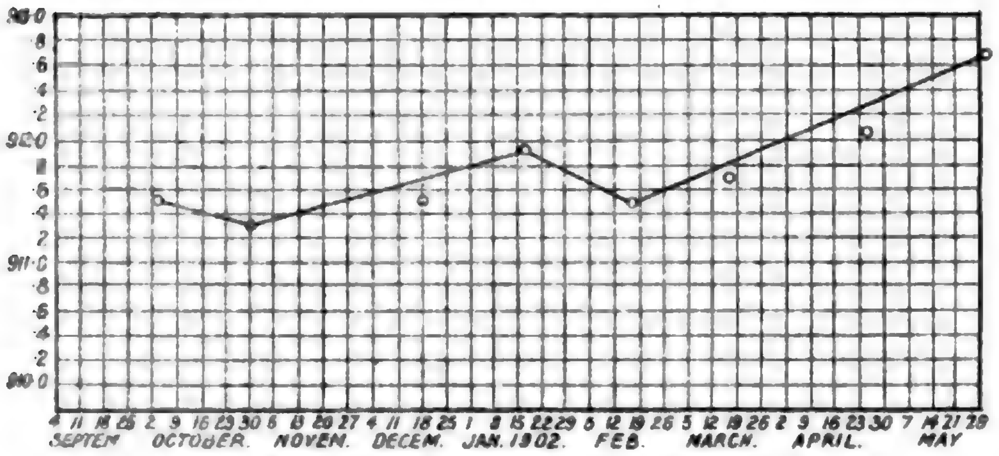
ZEISS FIGURE AT 45°C.

31. KILLYMAN.

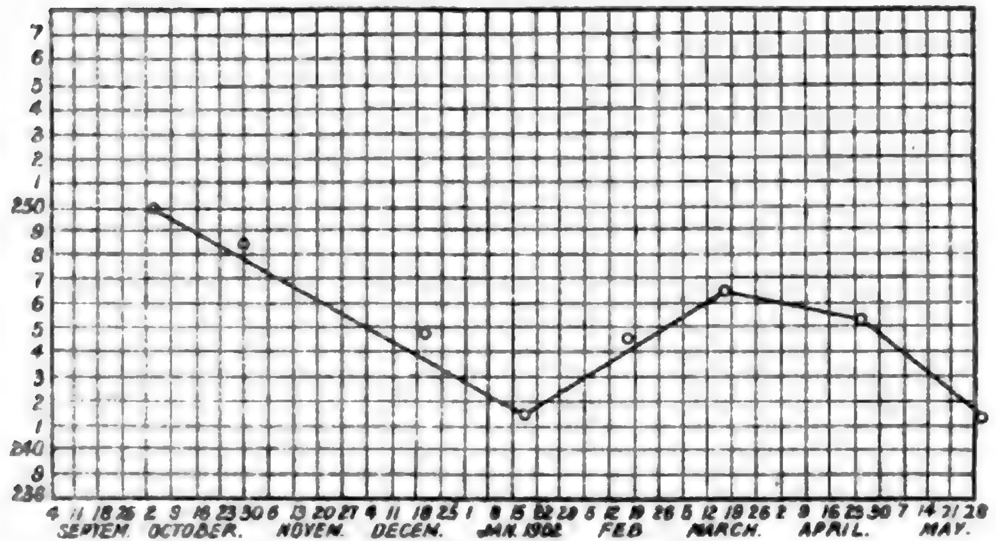
BREED OF COWS: *Crossbred*
NUMBER OF COWS: *Large herd, varying from 900 to 1200.*



REICHERT WOLLNY FIGURE.



SPECIFIC GRAVITY AT 100° F.



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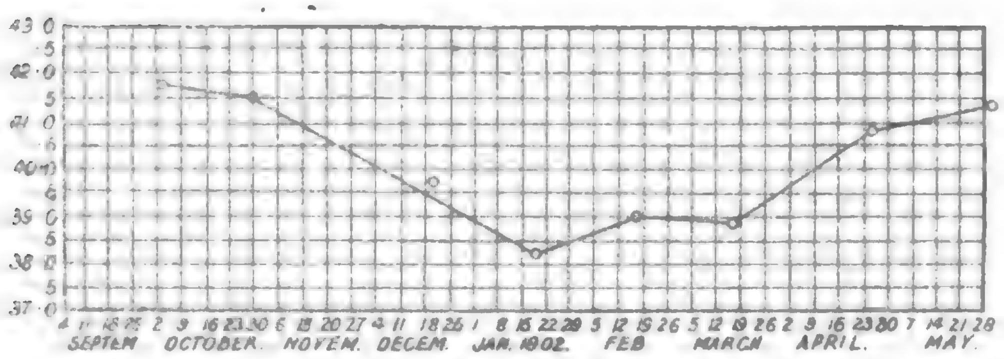
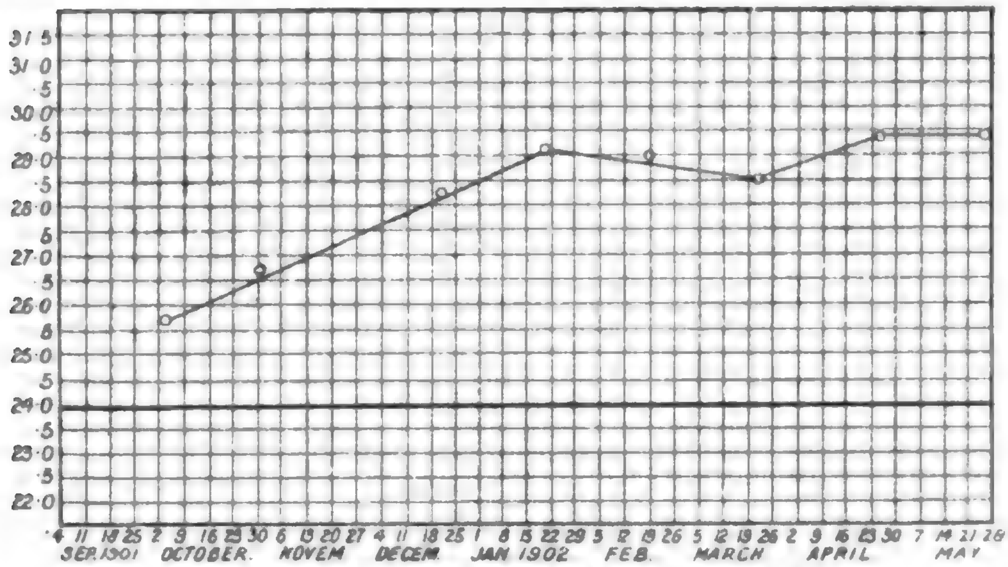


ZEISS FIGURE AT 45° C.

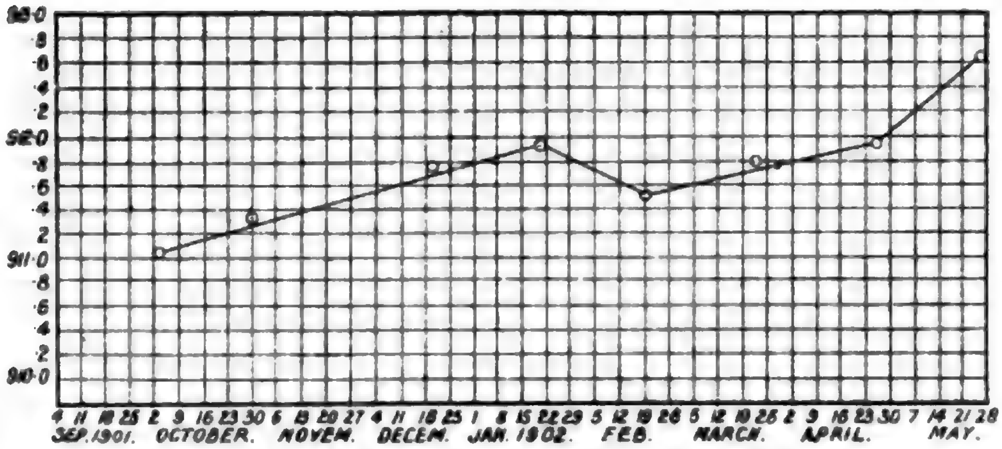
3679.0.03.

32. LOUGHBRICKLAND.

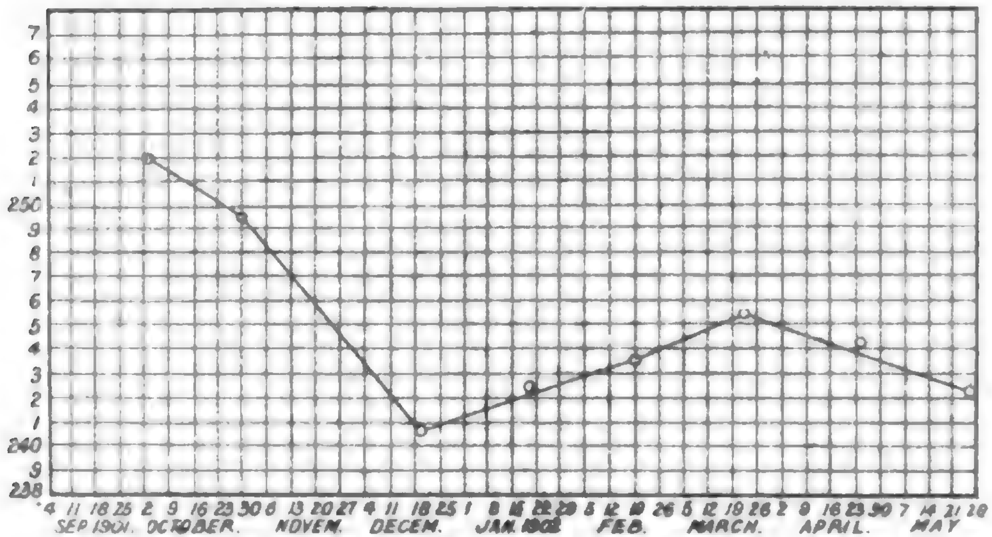
BREED OF COWS: *Crossbred*
NUMBER OF COWS: *Large herd, varying from 200 to 600.*



REICHERT WOLLNY FIGURE.



SPECIFIC GRAVITY AT 100° F.



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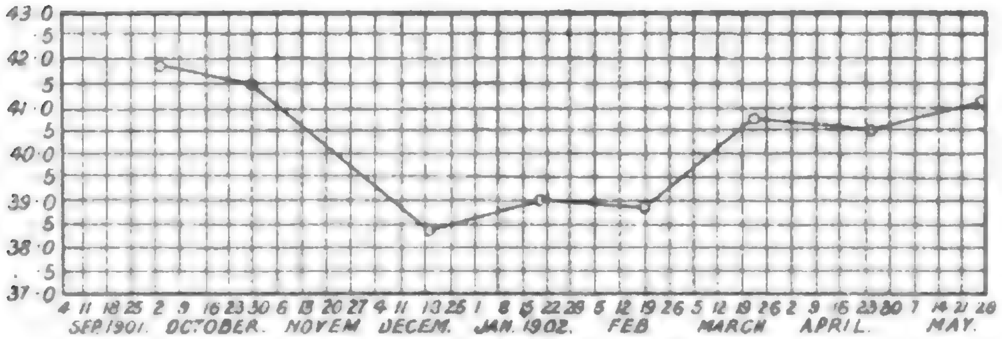
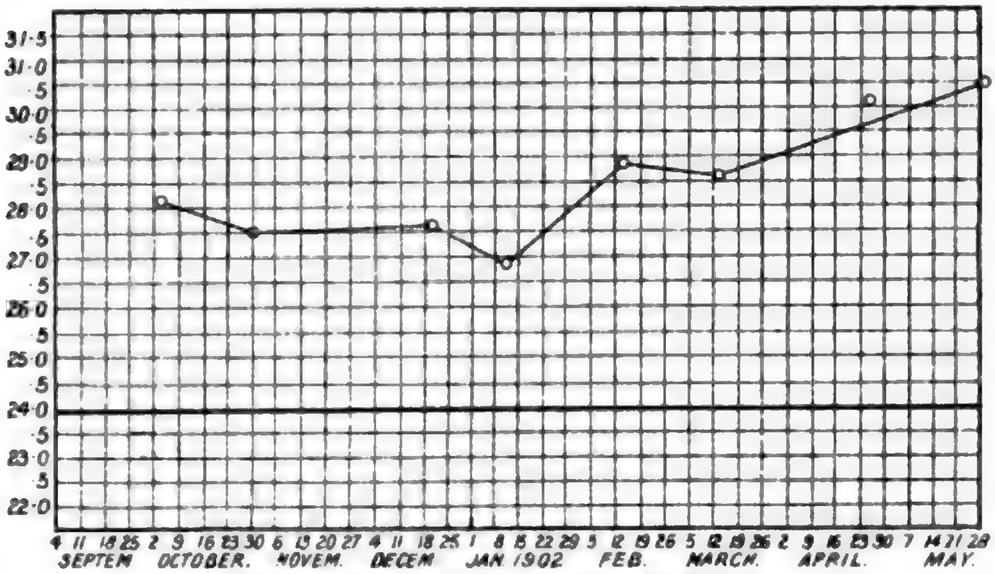


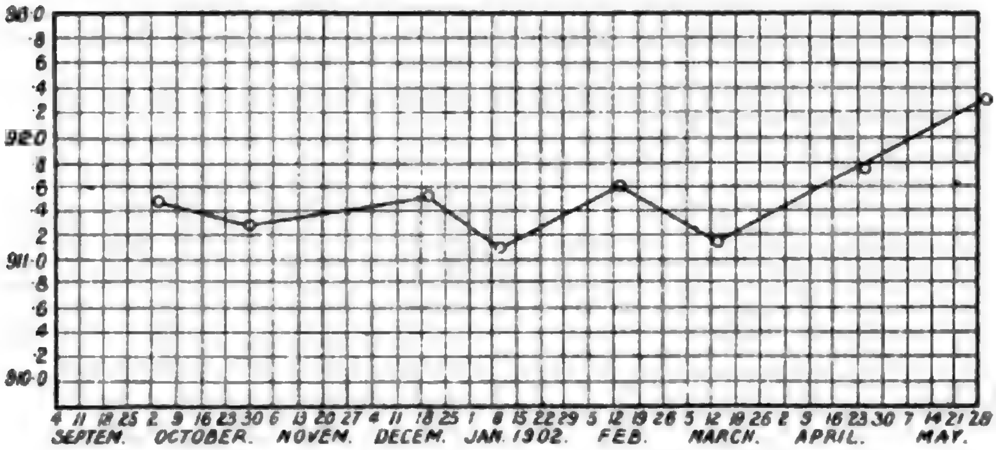
ZEISS FIGURE AT 45°C.

33. FINN VALLEY.

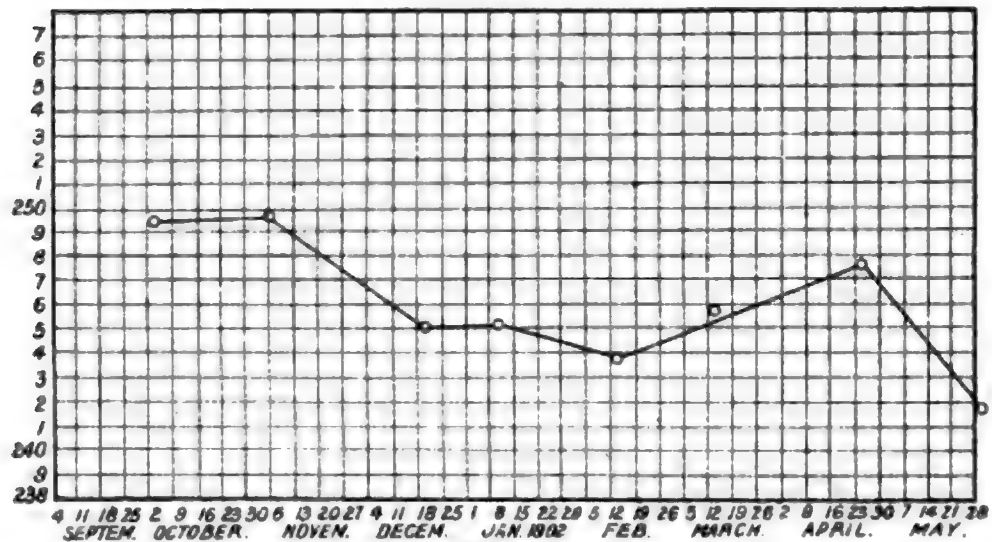
Breed of Cows: *Crossbred.*
Number of Cows: *Large herd varying from 700 to 1400.*



REICHERT WOLLNY FIGURE.



SPECIFIC GRAVITY AT 100° F.



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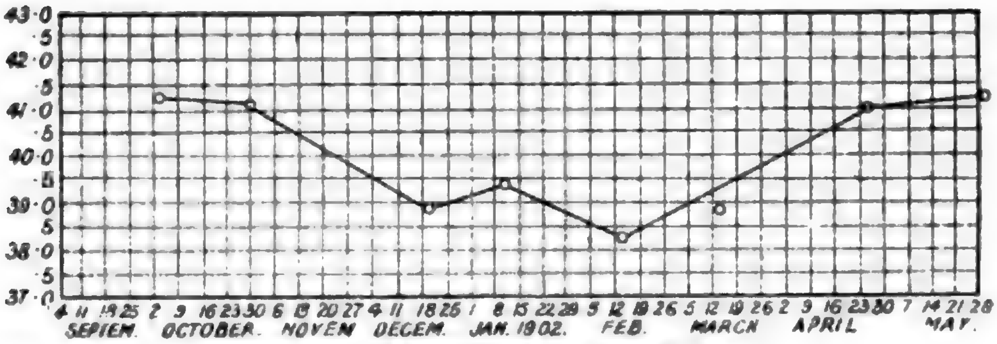
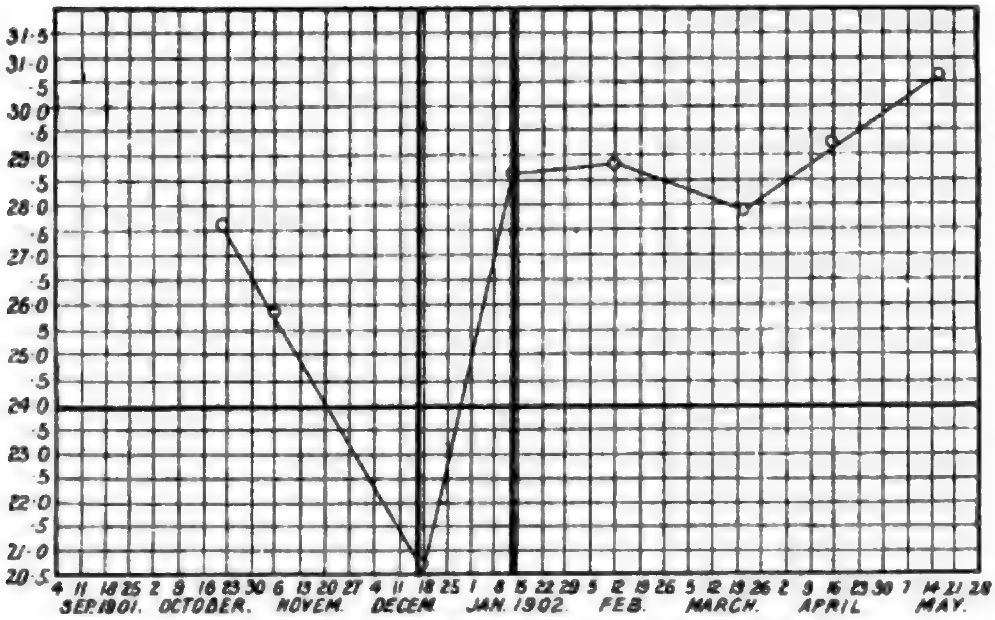


ZEISS FIGURE AT 45° C.

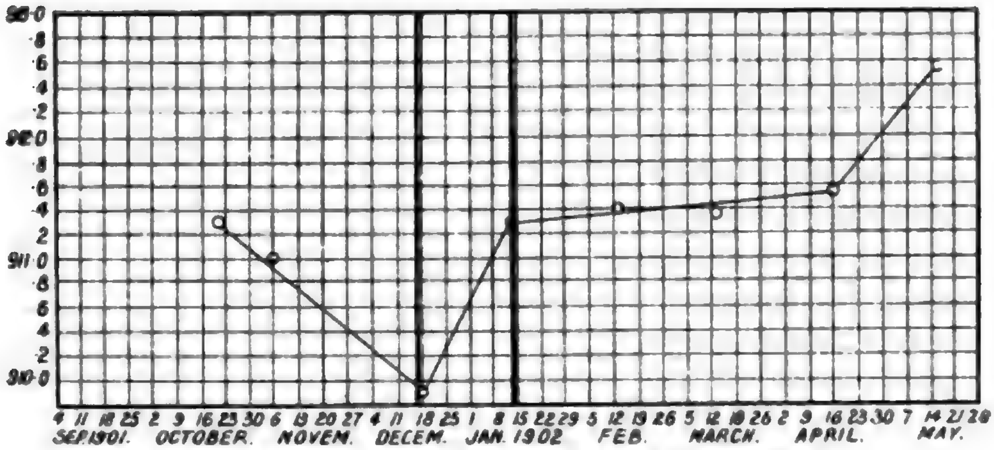
MUNSTER DAIRY SCHOOL, CORK.

Breed of Cows: *Shorthorn Crosses.*
Number of Cows: *17*
Lactation Period: *Oct. 10 to 2 mths; Dec. 7 to 5 mths; Jan. 1 to 5 mths., Feb. 1 to 6mths., March 1 to 9 mths; April 1 to 5 mths; May 1 to 8 mths.*

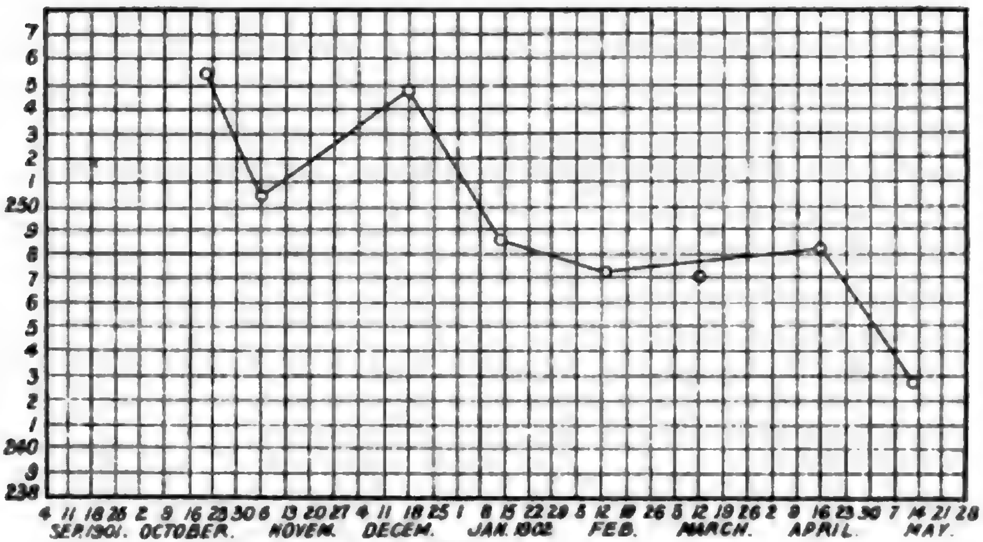
COWS OUTSIDE.	COWS INSIDE AT NIGHT	COWS INSIDE. *Special fodder, malt dust, mangolds. cotton cake, turnips & grains.*



REICHERT WOLLNY FIGURE.



SPECIFIC GRAVITY AT 100° F.



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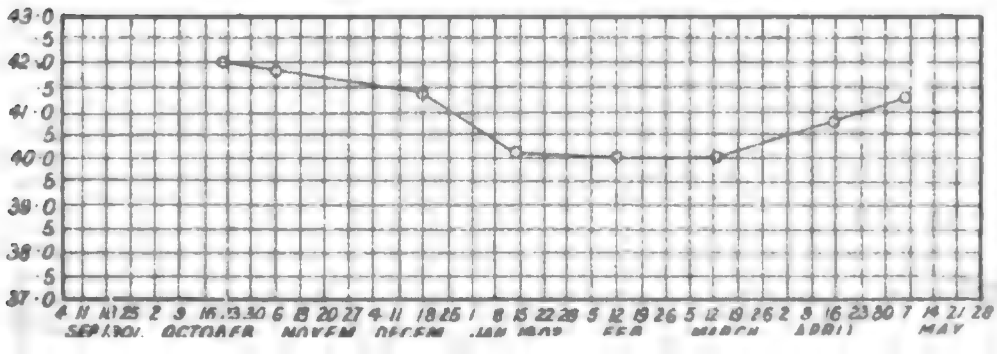
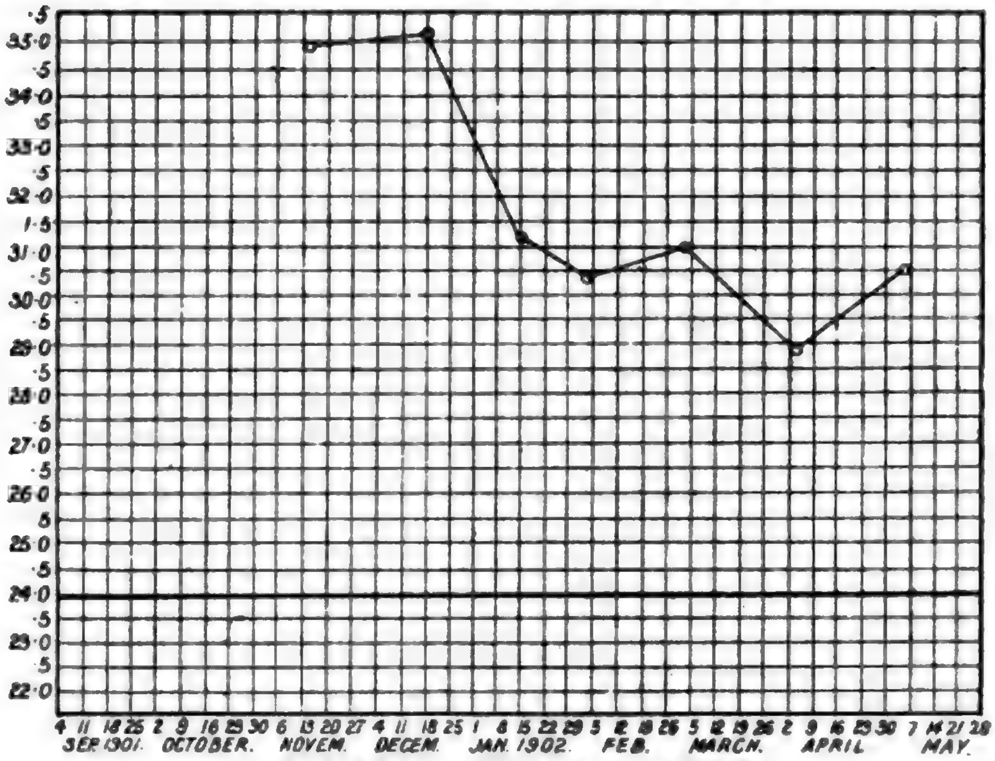
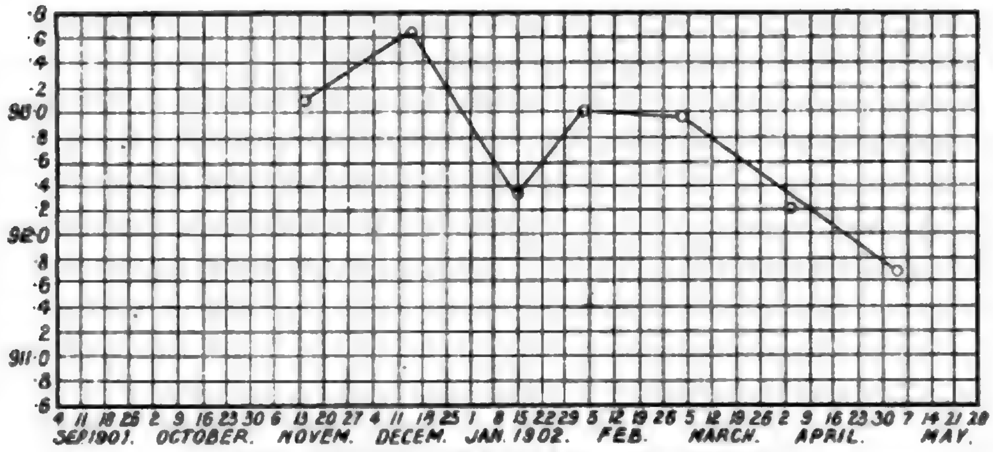


Breed of Cows: *Shorthorn Crosses.*
Number of Cows: 4
Lactation Period: *Cows calved from the 1st. to 4th Oct. 1901.*

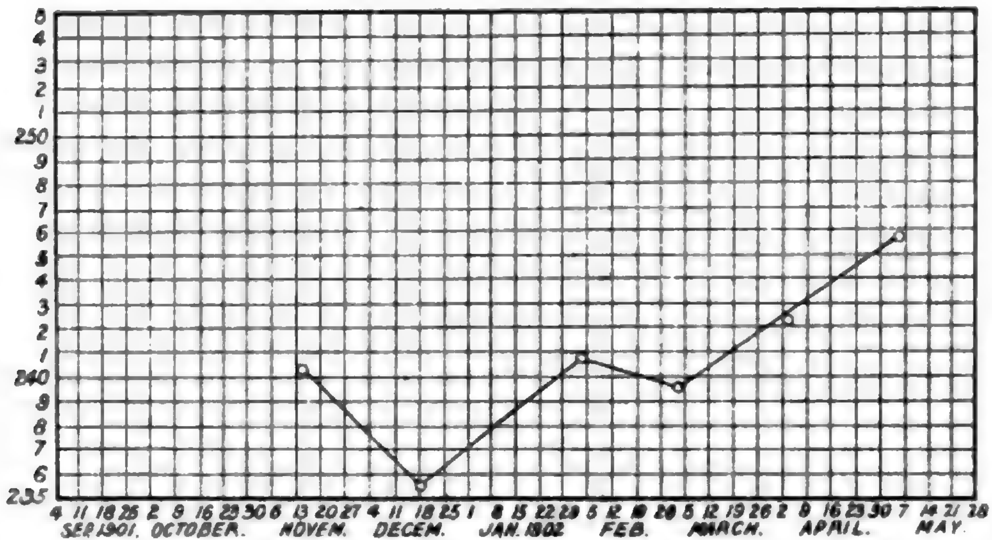
COWS INSIDE *throughout period.*
Special fodder, hay, mangolds, cotton cake, grains & bran.



REICHERT WOLLNY FIGURE.



SPECIFIC GRAVITY AT 100° F.



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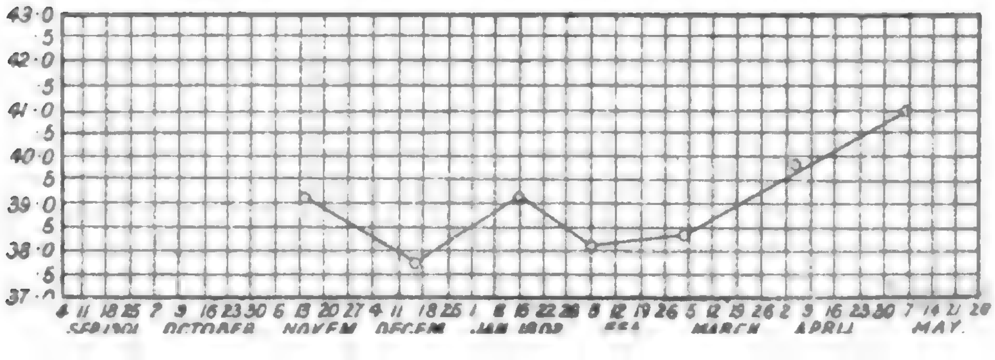
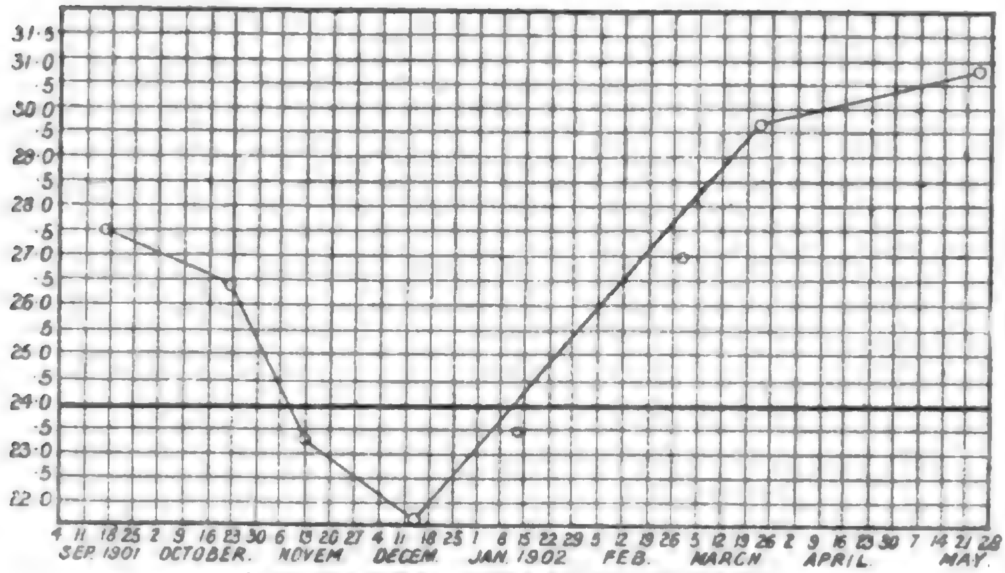
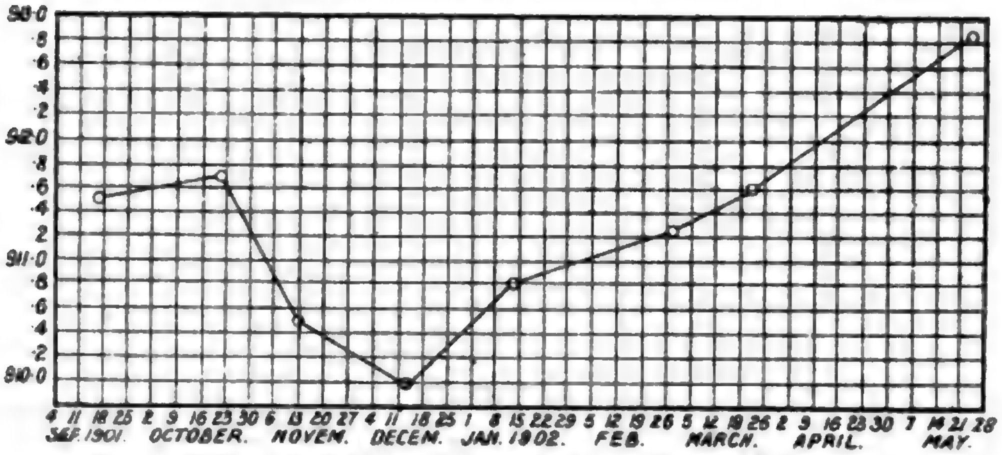


36. ARDAGH.

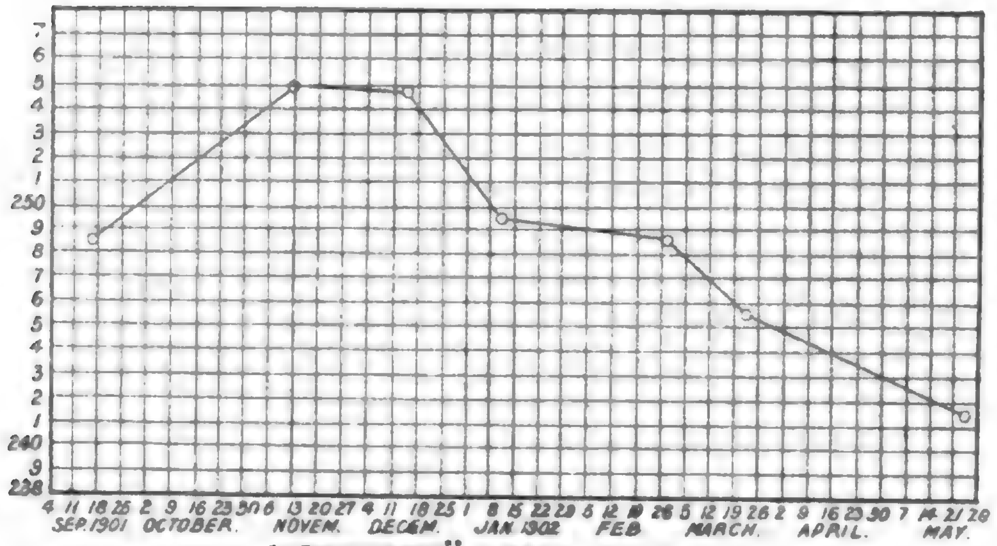
Breed of Cows: *Shorthorn Crosses.*
Number of Cows: *Large herd, varying from 1300 to 2100.*



REICHERT-WOLLNY FIGURE.



SPECIFIC GRAVITY AT 100° F.



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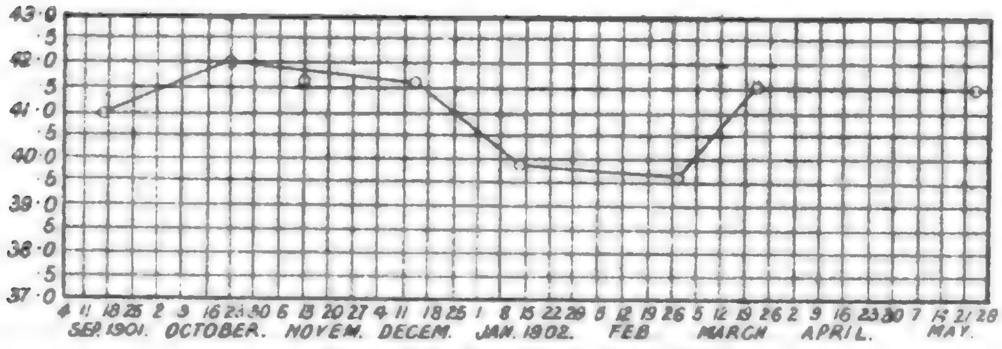
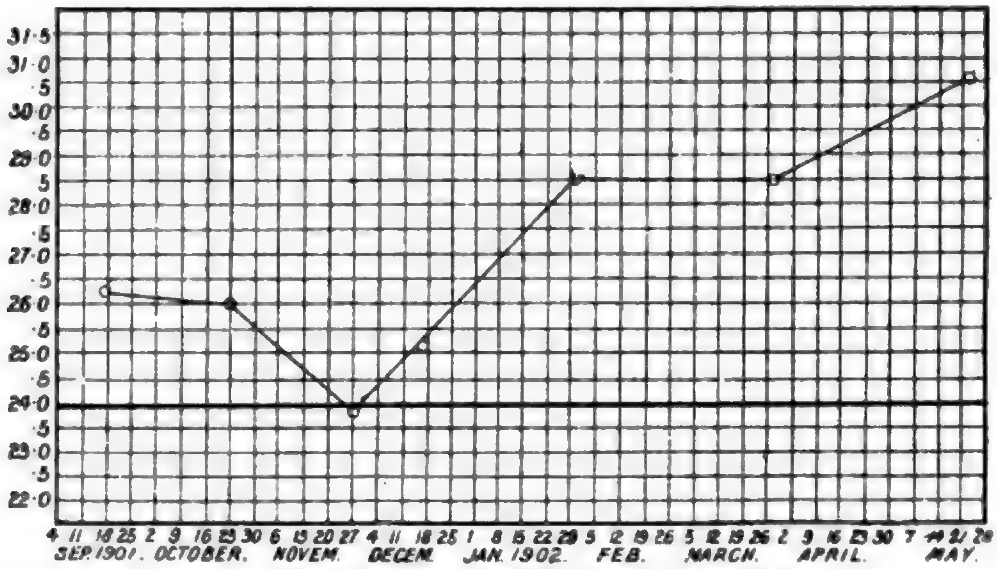


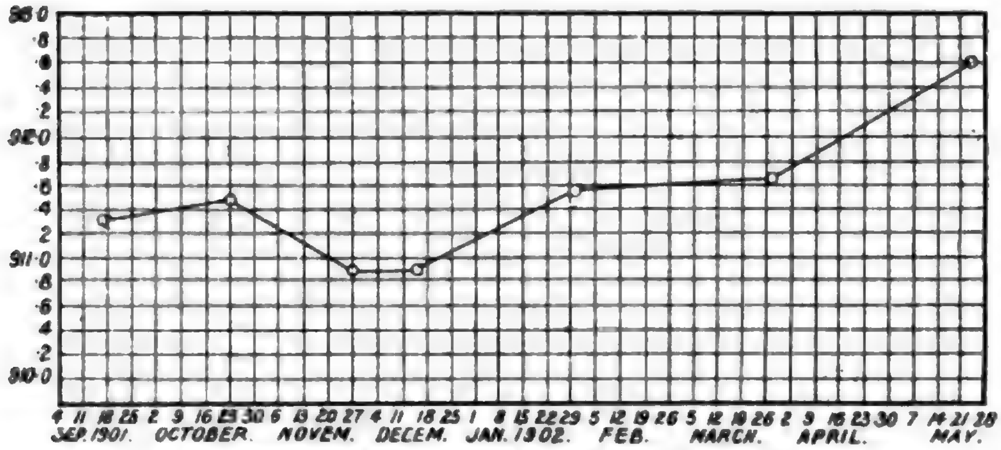
ZEISS FIGURE AT 45° C.

37. ABBEYDORNEY.

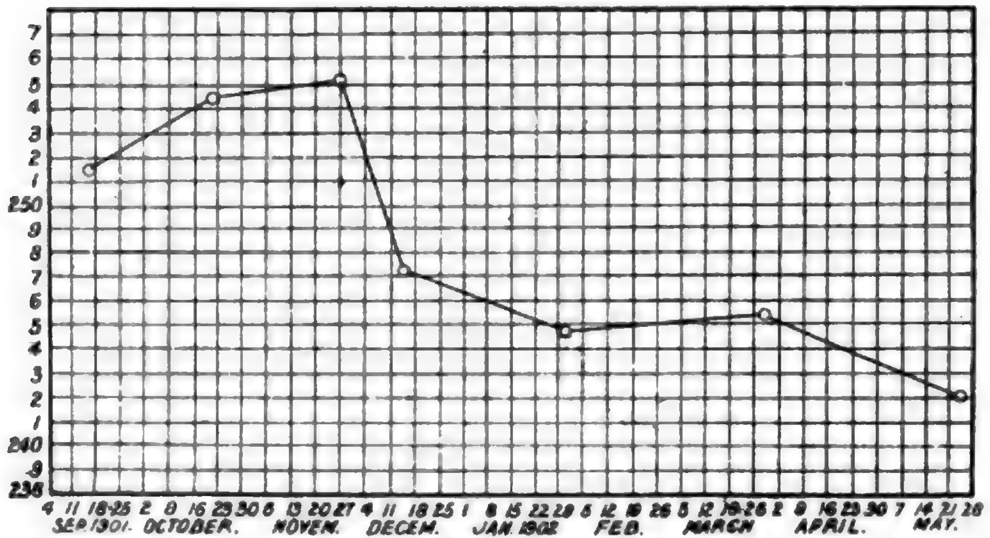
BREED OF COWS: *Shorthorn & Ayrshire.*
NUMBER OF COWS: *Large herd varying from 800 to 2000.*



REICHERT WOLLNY FIGURE.



SPECIFIC GRAVITY AT 100° F.



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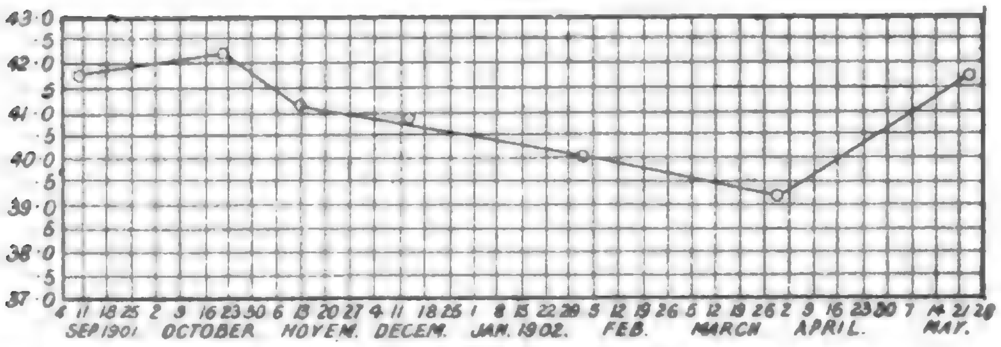
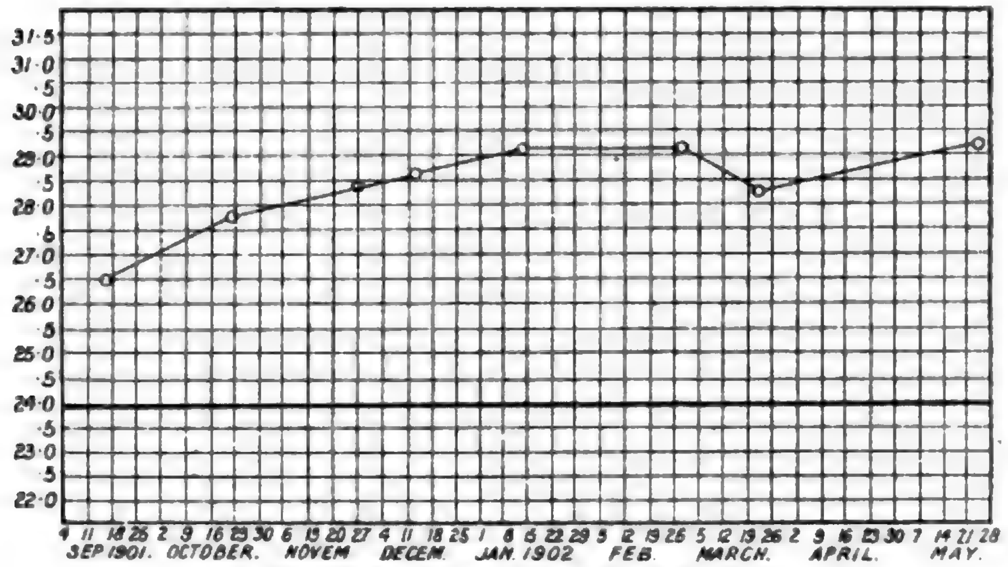


ZEISS FIGURE AT 45° C.

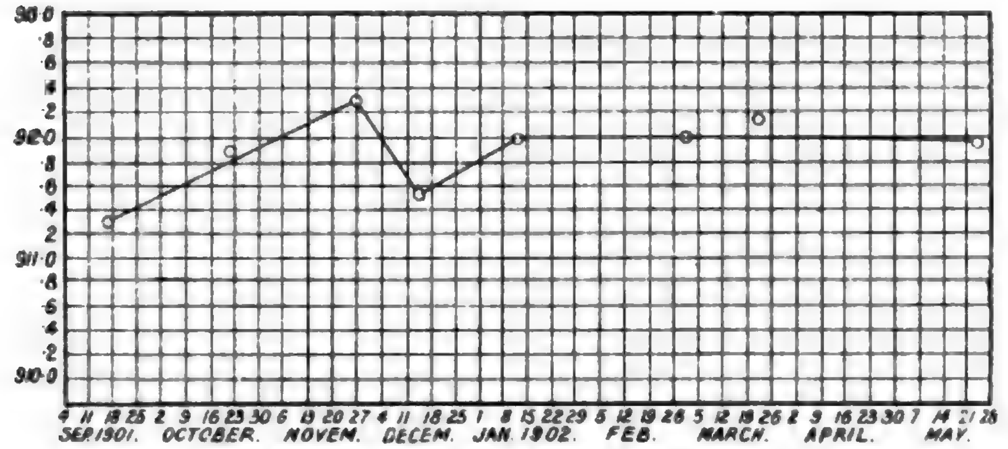
3979.4.02

38. MOURNE ABBEY.

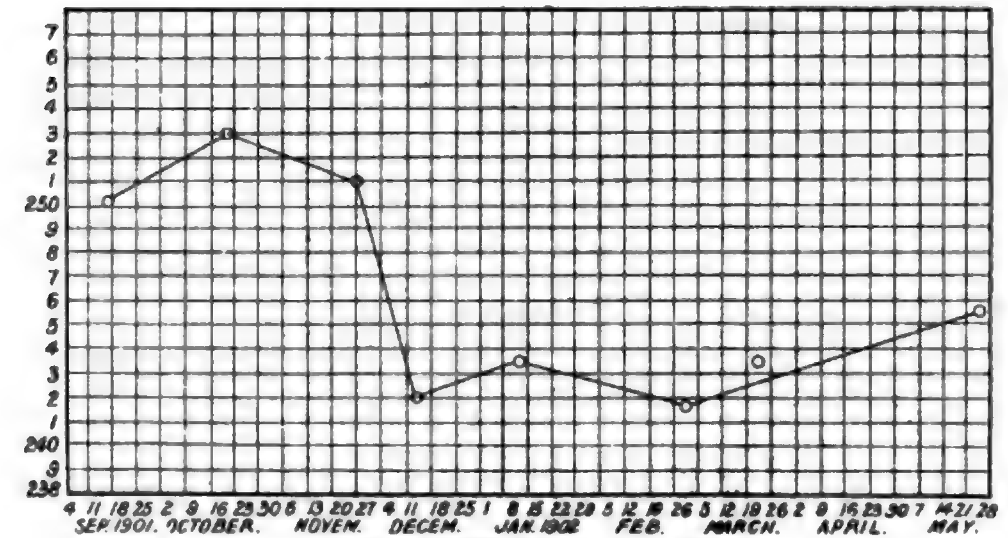
Breed of Cows: *Ayrshire.*
Number of Cows: *Large herd varying from 300 to 950.*



REICHERT-WOLLNY FIGURE.



SPECIFIC GRAVITY AT 100° F.



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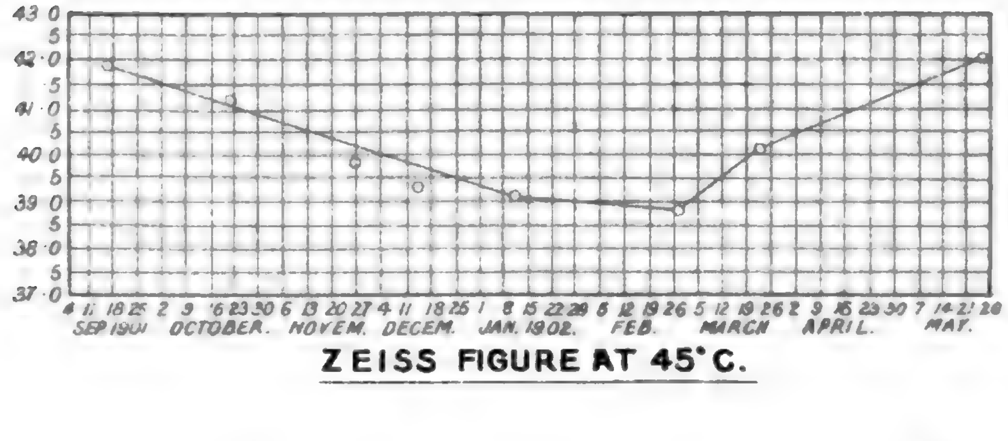
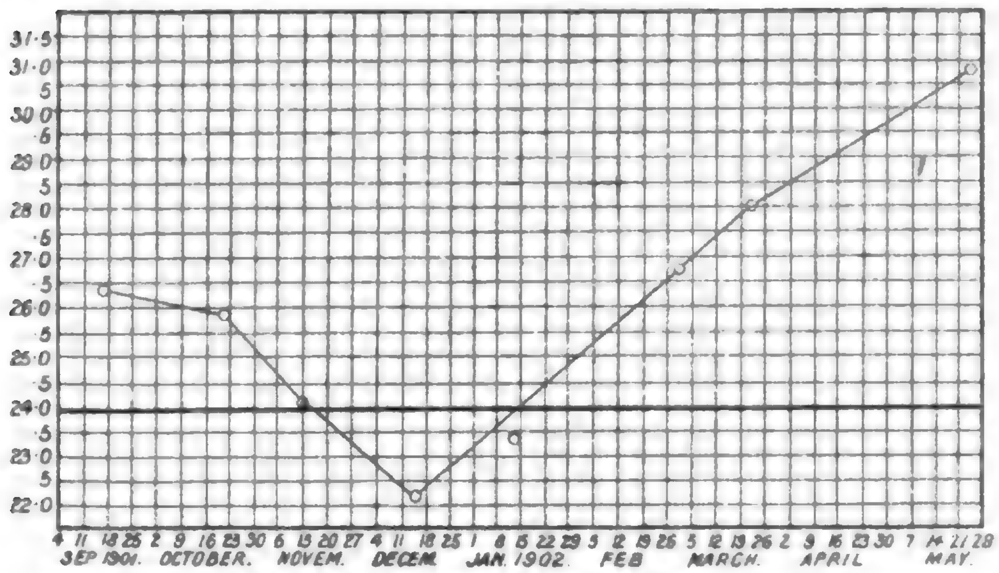


ZEISS FIGURE AT 45° C.

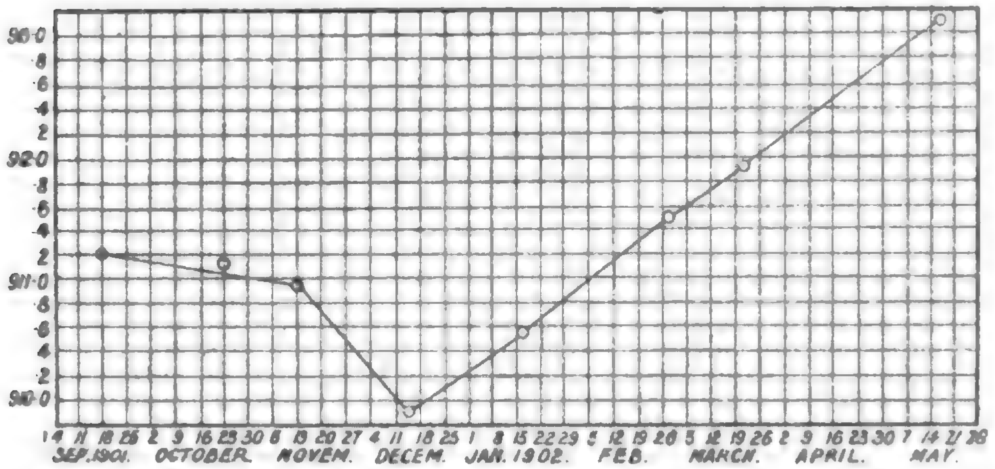
Weller & Graham [illegible]

39. ROSSMORE.

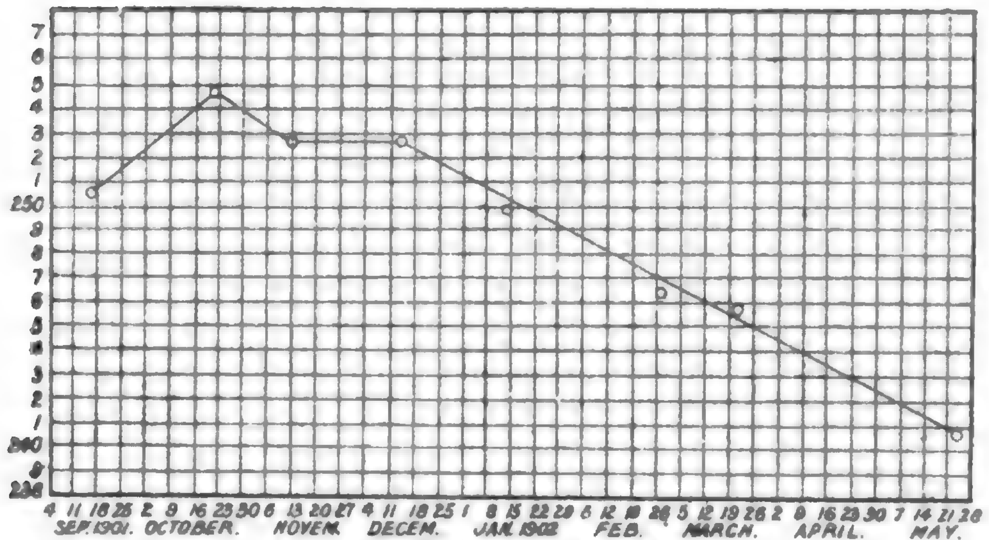
BREED OF COWS: *Shorthorn Crosses.*
NUMBER OF COWS: *Large herd varying from 1200 to 1500.*



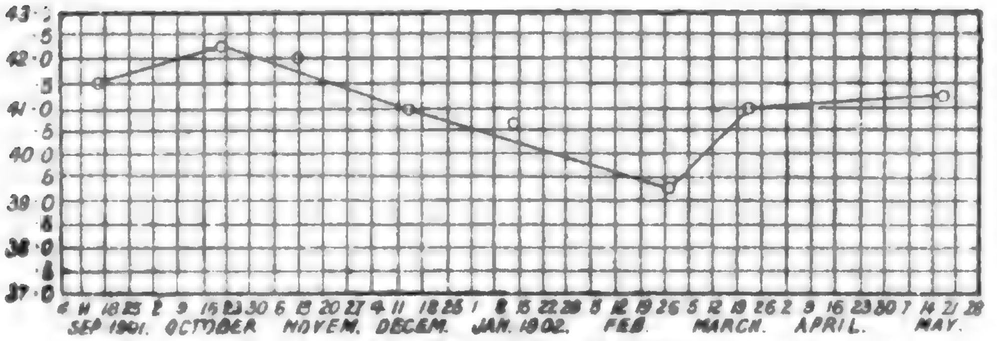
REICHERT-WOLLNY FIGURE.



SPECIFIC GRAVITY AT 100° F.



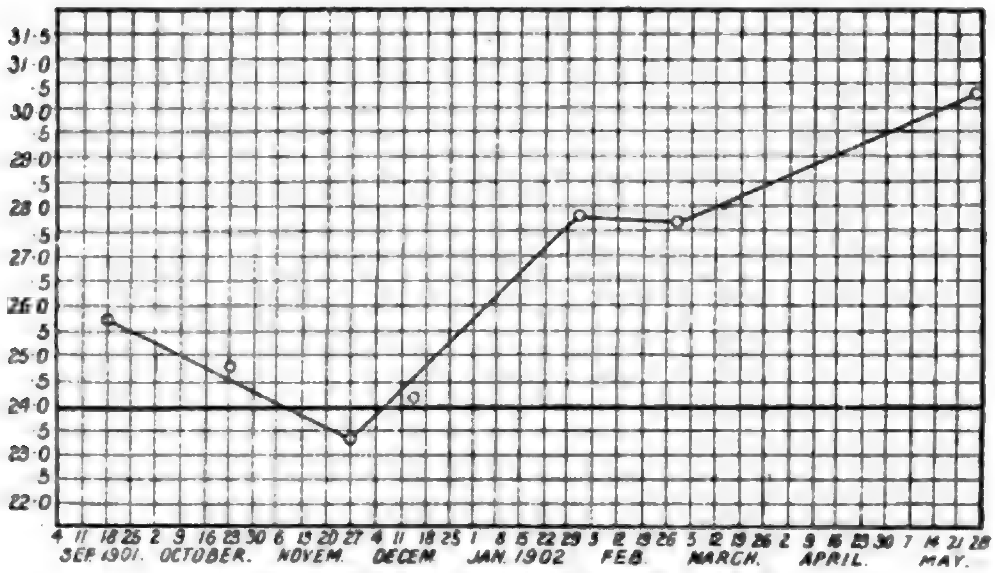
KOETTSTÖRFER NUMBER.



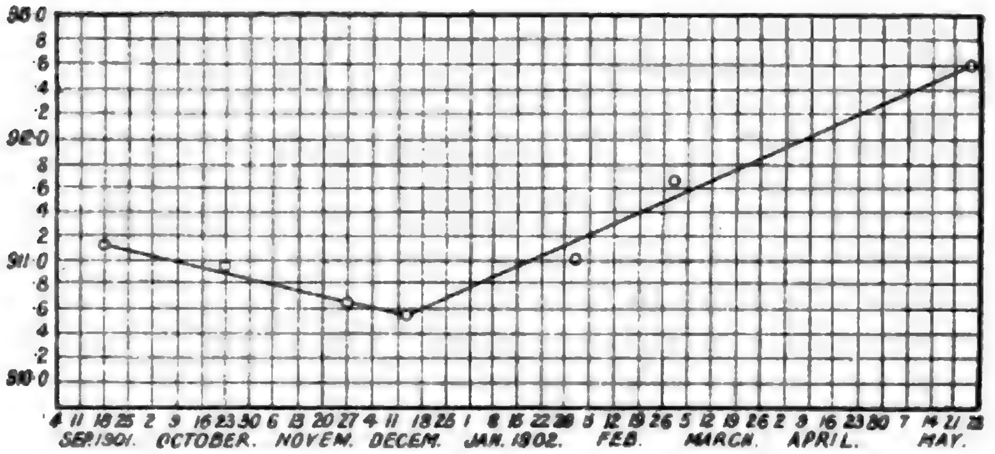
ZEISS FIGURE AT 45° C.

40. PILTOWN CREAMERY.

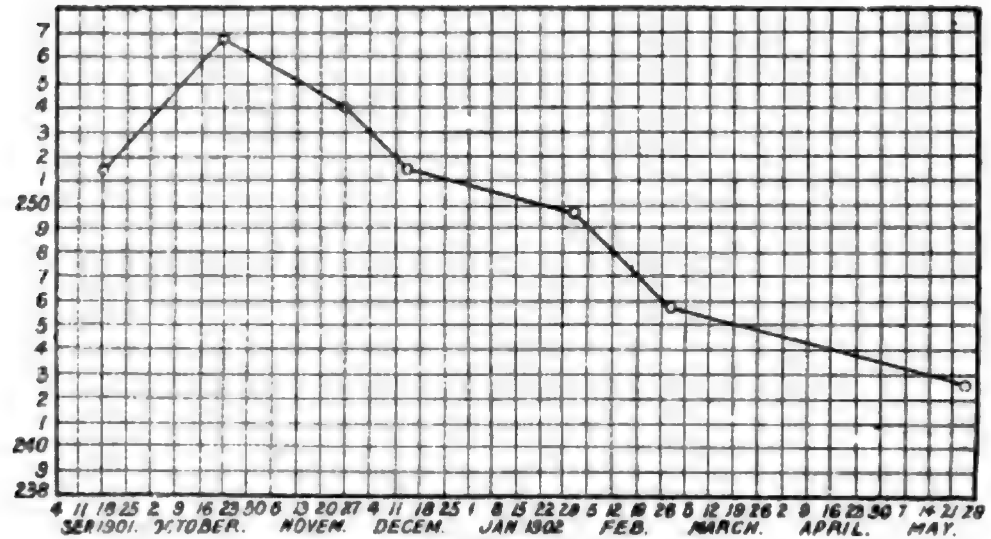
BREED OF COWS: *Mixed Ayrshire & Irish.*
NUMBER OF COWS: *Large herd varying from 400 to 1700.*



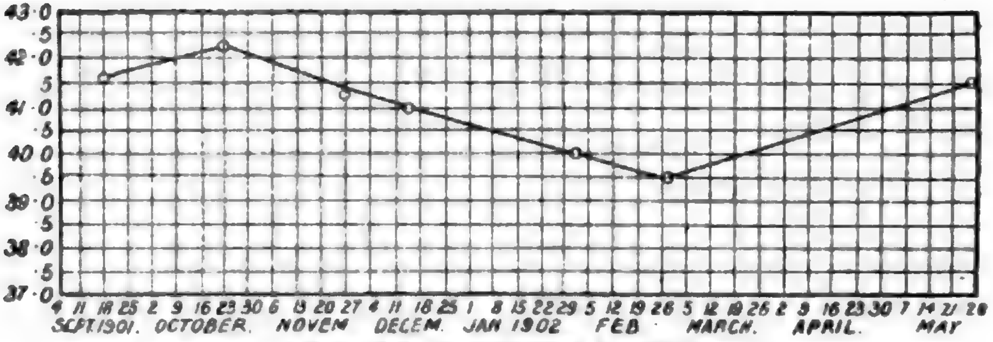
REICHERT WOLLNY FIGURE.



SPECIFIC GRAVITY AT 100° F.



KOETTSTÖRFER NUMBER.



ZEISS FIGURE AT 45° C.

3070.4.08.

Weller & Graham Ltd Litho.

APPENDIX XXX.

SPECIAL ENQUIRY INTO THE COMPOSITION OF BRITISH BUTTER.

RESULTS OBTAINED AT THE GOVERNMENT LABORATORY.

THE REICHERT-WOLLNY Nos. of 357 Samples, see Q. 10568.

NAME of FARM, CREAMERY, or INSTITUTE.	1901.								1902.				
	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.
ENGLAND AND WALES:													
1. S. E. Agricultural College, Wye (18 samples)*	29·7 to 32·8	25·2 to 29·7		–	–	–	–		–	–	–	–	–
2 Eastern Counties Dairy Institute, Ipswich	30·9	27·5	25·3	24·5	27·6	25·8	–	–	–	–	–	–	–
3 Mr. G. Taylor's Dairy, Whitlingham, Norwich.	26·1	26·0	26·8		24·0	24·9	28·9	30·1	29·1	30·6	30·4	27·6	–
4 Wrotham Park Farm, Barnet	29·0	30·1	30·7	29·8	29·5	28·5	30·5	28·6	28·8	28·3	28·4	30·6	–
5 Westmorland and Cumberland C. C. Farm, Newton Rigg, Penrith.	29·3	28·8	26·2	26·3	24·0	25·2	23·8	30·4	30·9	27·1	27·8	29·1	–
6 E. and W. Ridings C. C. Farm, Garforth, Leeds	28·3 27·5	27·9 28·9	28·4 26·7	25·1 23·4	23·6 23·0	19·4 19·9	23·4 23·3	24·4 25·1	25·6 27·3	22·0 23·1	–	– –	– –
7. Buscot Park Dairy, Faringdon	29·6	29·3	27·2	26·4	27·5	28·0	–	–	28·8	–		28·4	29·9
8. University College of North Wales, College Farm Lledwigan, Llangefni, Anglesey.	28·8	27·6	28·2	25·3	25·2	25·4	25·2	24·3	28·8	28·0	28·1	26·7	–
9 Sharcombe, Wells, Somerset	28·8	29·4	27·7	27·7	26·0	25·7	28·1	28·7	29·5	28·9	30·4	29·1	–
0. Midland Dairy Institute, Kingston, Derby	28·4	27·7	22·5	23·5	22·4	22·3	21·7	24·8	30·7	31·6	29·9	29·5	–
1. Colonial College, Hollesley Bay, Suffolk	29·7 31·3	29·0 28·8	28·0 28·2	–	28·5	–	29·1	–	–	–	–	–	–
2 Manor Farm, Gloucester	31·3	27·7	27·1	27·2	26·6	–	–	–	–	–	–	–	–
3 Carrick's Dairy, Cumberland	28·8	–	–		–	28·1	–	–	–	–	–	–	–
4 Somerset County Council Farm, Bickenhall, near Taunton.	28·1	29·6	26·8	27·1	29·1	27·0	26·5	29·4	–	28·1	27·1	–	–
SCOTLAND:													
5 Dunragit Creameries	28·6	29·3	31·0	27·7	25·6	25·2	26·2	26·3	29·7	30·9	30·6	30·6	–
6 Newton Farm, Glasgow	–	26·7	26·6	24·5	23·0	22·9	23·9	27·1	–	–	–	–	–
7. Wester Fowlis, Alford, Aberdeen	29·5	28·0	26·9	27·6	29·5	29·6	26·7	–	28·2	–	–	–	–
8. West of Scotland Agricultural College, Kilmarnock.	32·0	29·3	29·5	30·2	28·2	–	–	–	–		–	–	–
9 Cogle Watten, Caithness, N.B.	30·9	35·6	31·0	28·9	27·2	26·0	32·9	29·0	29·2	29·9	34·3	33·1	–
0 Shinness, Lairg, Sutherland	29·9	32·5	32·6	30·2	29·2	25·4	24·3	–	–	–	31·3	29·3	–
1. Latheron Wheel, Caithness	26·5	30·8	30·7	27·9	25·8	25·8	22·9	29·9	28·4	29·3	32·7	30·0	–
2 Sanday Farm, Orkney Islands	28·8	–	29·3	25·8	23·6	–	27·5	26·8	28·1	26·9	–	–	–
3 Brora, Sutherland		32·8	29·2	30·2			–	–	–		–	–	–
4. East Langwell, Rogart	–	29·4	30·5	28·0		27·2	28·7	25·4	31·0	31·3	28·6	28·7	28·2
5 Strathcroy, Sutherland	–	31·7	28·0	28·5	27·5		27·8	–		–	–	–	–
6. Gerinish, South Uist	–	–	30·4	28·2		29·2	26·3	–	–	–	–	–	–
7. Dremisdale, South Uist	–	31·1	–	30·5	27·9	29·4	26·0	23·9	26·0	30·4	30·7	25·3	27·5
8 Sumburgh Farm, Shetland Island	–	–	31·4	28·6	27·2	25·0	–	27·5	–	–	31·3	28·0	30·6
IRELAND:													
9. Aghadowey	–	–	–	–	–	28·1	26·9	27·6	27·6	28·1	28·1	27·9	30·4
0. Scottish Wholesale, Enniskillen			–		–	26·6	27·7	24·8	25·3	24·9	26·0	29·7	31·1
1. Killyman	–	–		–	–	27·3	26·4	27·8	29·3	27·7	28·4	28·9	29·9
2 Loughbrickland	–	–			–	25·7	26·6	28·3	29·0	28·9	28·4	29·4	29·4
3 Finn Valley	–	–	–	–	–	28·1	27·5	27·5	26·8	28·9	28·6	30·1	30·4
4 Munster Dairy School, Cork	–	–	–	–	–	27·6	25·8	20·6	28·4	28·7	27·9	29·2	30·6
5 Albert Farm, Glasnevin	–	–	–	–	–	–	34·9	35·1	31·1	30·3	31·0	28·9	30·5
6 Ardagh			–	–	27·4	26·3	23·2	21·6	23·5	27·0	29·6	–	30·8
7 Abbeydorney	–	–	–	–	26·3	26·0	23·0	25·0	–	28·5	28·5	–	30·5
8. Mourne Abbey	–	–	–	–	26·5	27·7	28·4	28·6	28·6	29·0	28·2	–	29·2
9 Rossmore	–	–	–	–	26·3	28·5	24·1	22·0	23·4	26·7	28·0	–	30·9
0 Piltown Creamery	–	–	–	–	25·6	24·7	28·8	24·1	–	27·7	27·6	–	30·2

* In March 1901: 25·7 to 32·3.

APPENDIX XXX.—*continued.*

The PERCENTAGE of Butter Fat in 357 Samples.

NAME OF FARM, CREAMERY, OR INSTITUTE.	1901.								1902.			
	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.
ENGLAND AND WALES:												
1. S. E. Agricultural College, Wye (18 samples)*	84·15 to 87·04	80·44 to 87·21		-	–	–	–	–	–	–	–	
2. Eastern Counties Dairy Institute, Ipswich	85·84	86·16	87·22	85·41	86·65	86·12	-	–	–	–	–	–
3. Mr. G. Taylor's Dairy, Whitlingham, Norwich.	86·15	86·98	86·09	–	86·89	84·67	86·57	86·16	87·31	84·06	83·75	89·18
4. Wrotham Park Farm, Barnet	85·78	86·62	84·80	86·16	85·40	86·60	87·74	87·33	87·29	86·79	88·28	[illegible]
5. Westmorland and Cumberland C. C. Farm, Newton Rigg, Penrith.	85·90	84·90	85·09	85·84	87·19	85·11	86·86	87·58	88·21	85·22	86·66	[illegible]
6. E. and W. Ridings C. C. Farm, Garforth, Leeds.	85·85 87·89	83·86 85·49	83·04 84·19	84·72 88·09	86·97 86·46	86·24 86·97	87·28 84·85	86·62 85·39	86·17 83·62	86·08 85·36	– -	– -
7. Buscot Park Dairy, Faringdon	85·33	86·54	87·52	87·19	86·43	86·06		-	87·75	–	-	88·42
8. University College of North Wales, College Farm, Lledwigan, Llangefni, Anglesey.	85·78	87·10	87·19	84·38	84·06	84·38	83·60	87·59	86·97	84·50	86·47	[illegible]
9. Sharcombe, Wells, Somerset	88·06	88·47	87·55	87·60	88·18	88·56	88·70	89·16	88·41	87·28	88·28	87·73
10. Midland Dairy Institute, Kingston, Derby	87·38	85·56	85·95	87·18	86·57	86·58	86·34	87·33	86·95	87·64	90·19	89·72
11. Colonial College, Hollesley Bay, Suffolk	86·62 85·86	85·01 88·00	79·86 79·63	– –	87·18	–	85·41	–	–	–	–	
12. Manor Farm, Gloucester	87·70	84·54	84·55	86·06	84·34	–	-	-		–	–	-
13. Carrick's Dairy, Cumberland	89·61		–	-	–	83·91	–	–	–	–	–	-
14. Somerset County Council Farm, Bickenhall, near Taunton.	86·98	87·58	86·10	84·44	86·47	86·54	86·65	89·16	89·90	88·80	86·78	
SCOTLAND:												
15. Dunragit Creameries	84·57	83·61	84·55	84·36	84·53	84·19	85·05	83·36	79·37	83·95	88·37	87·44
16. Newton Farm, Glasgow	–	83·28	83·15	84·52	82·13	83·17	83·53	80·86	-	–	–	–
17. Wester Fowlis, Alford, Aberdeen	85·44	85·13	83·48	84·58	84·80	85·92	79·91	–	79·75	–	-	-
18. West of Scotland Agricultural College, Kilmarnock.	88·44	84.44	86·78	85·62	86·42	-		-	–	–	–	-
19. Cogle Watten, Caithness, N.B.	89·20	86·06	86·01	85·63	83·04	84·90	87·39	84·79	84·28	84·14	86·91	85·15
20. Shinness, Lairg, Sutherland	87·49	85·86	70·71	85·43	85·02	82·92	82·81	–	–	–	86·60	84·98
21. Latheron Wheel, Caithness	88·08	87·45	84·86	86·85	83·58	85·98	86·72	85·31	86·86	88·60	86·94	85·54
22. Sanday Farm, Orkney Islands	88·23		80·58	84·95	85·54	84·94	84·35	82·11	81·61	-	–	
23. Brora, Sutherland	84·42	87·80	83·11	-		–	–	–	–		–	-
24. East Langwell, Rogart	79·17	82·83	82·61	–	83·87	82·18	80·92	83·77	84·62	81·74	84·28	84·78
25. Strathcroy, Sutherland	–	81·88	84·03	79·14	80·33	77·53	–	–	-	–	–	
26. Gerinish, South Uist	–	-	82·65	82·06	81·32	82·36	-	–	–	–	-	–
27. Dremisdale, South Uist	–	82·85		82·42	82·80	78·91	84·89	83·35	83·63	81·36	85·13	79·48
28. Sumburgh Farm, Shetland Island	–	-	81·35	85·06	82·98	82·36		82·43	–	–	86·36	79·31
IRELAND:												
29. Aghadowey						84·87	84·30	84·25	81·91	84·90	81·89	83·80
30. Scottish Wholesale, Enniskillen	–	–	–	–	–	82·62	84·58	83·25	83·31	84·80	85·08	83·90
31. Killyman				-		86·01	85·86	84·43	83·24	82·12	84·49	84·74
32. Loughbrikland						85·29	84·64	83·25	81·84	83·62	84·93	84·58
33. Finn Valley		–				83·46	85·60	83·19	84·88	82·92	82·82	87·63
34. Munster Dairy School, Cork	–	–		–	–	85·74	85·10	84·75	84·22	81·64	84·75	84·45
35. Albert Farm, Glasnevin						–	88·94	86·97	87·58	85·51	85·20	85·42
36. Ardagh		–	–	–	82·48	82·40	84·23	83·93	85·15	82·76	82·23	-
37. Abbeydorney	–	-		-	82·90	84·40	84·63	84·21	–	84·46	84·03	-
38. Mourne Abbey	–		–	–	83·96	85·74	80·72	84·48	84·63	83·63	86·49	–
39. Rossmore	–			–	84·17	82·08	83·21	84·30	84·36	82·54	84·27	–
40. Piltown Creamery	–		–	-	82·07	81·92	83·01	84·01	–	79·54	79·50	-

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* In March, 1901, 83·73 to 85·47.

XX.—*continued.*

Appendix XXX.

FAT IN 339 SAMPLES OF BUTTER.

	mber.		December.						
	Salt.	Fat.	Water.	Curd.	Salt.	Fat.	Water.	Fat.	NAME of FARM, CREAMERY, or INSTITUTE.
									ENGLAND AND WALES:
1.	–	–	–	–	–	–	–	–	1. S. E. Agricultural College, Wye (18 samples).
2.	–	–	–	–	–	–	–		2. Eastern Counties Dairy Institute, Ipswich.
3.	1·10	86·57	12·04	·46	1·34	86·16	11·2		3. Mr. G. Taylor's Dairy, Whitlingham, Norwich.
4.	·45	87·74	11·38	65	·64	87·33	11·74		4. Wrotham Park Farm, Barnet.
5.	1·20	86·86	11·02	·66	·74	87·56	9·90		5. Westmorland and Cumberland C. C. Farm, Newton Rigg, Penrith.
6.	·91 ·90	87·28 84·85	12 26 13 60	·42 ·69	·70 ·32	86·62 85·39	12·75 15·52		6. E. and W. Ridings C. C. Farm, Garforth, Leeds.
7.	–	–	–	–	–	–	11·05		7. Buscot Park Dairy, Faringdon.
8.	1·54	83·60	11·17	·21	1·03	87·59	11·72	6	8. University College of North Wales, College Farm, Lledwigan, Llangefni, Anglesey.
9	1·01	88·70	10·00	·24	·60	89·16	10·70		9. Sharcombe, Wells, Somerset.
10.	·88	86·34	10·82	·61	1 24	87·33	10·52		10. Midland Dairy Institute, Kingston, Derby.
11.	1·08	85·41	–	–	–	–	–		11. Colonial College, Hollesley Bay, Suffolk.
12.	–	–		–	–	–	–		12. Manor Farm, Gloucester.
13.	–	–	–	–	–	–	–		13. Carrick's Dairy, Cumberland.
14.	·23	86·65	10·20	·24	·40	89·16	10·34		14. Somerset County Council Farm, Bickenhall, near Taunton.
									SCOTLAND:
15.	·04	85·05	15·72	·92	trace	83·36	19·58		15. Dunragit Creameries.
16.	race	83·53	18·44	·70	trace	80·86	–		16. Newton Farm, Glasgow.
17.	race	79·91	–	–	–	–	18·91		17. Wester Fowlis, Alford, Aberdeen.
18.	–	–	–	–	–		–		18. West of Scotland Agricultural College, Kilmarnock.
19.	1·22	87·39	12·83	1·01	1·37	84·79	13·59		19. Cogle Watten, Caithness, N.B.
20.	race	82·81	–	–	–	–	–		20. Shiness, Lairg, Sutherland.
21.	·24	86·72	14·10	·46	·13	85·31	12·49		21. Latheron Wheel, Caithness.
22.	1·10	84·35	15 26	1·24	1·39	82·11	14·75		22. Sanday Farm, Orkney Islands.
23.	–	–	–	–	–	–	–		23. Brora, Sutherland.
24.	race	82 18	17·78	1·30	trace	80·92	15·21		24. East Langwell, Rogart.
25.	–	–	–		–		–		25. Strathcroy, Sutherland.
26.	–	–	–	–	–				26. Gerinish, South Uist.
27.	3·40	84·89	13·01	1·60	2·04	83·35	11·72		27. Dremisdale, South Uist.
28.	–	–	14·35	1·09	2·13	82·43	–		28. Sumburgh Farm, Shetland Island.
									IRELAND:
29.	·91	84·30	12·90	·88	2·97	84·25	13·12		29. Aghadowey.
30.	·88	84·58	13·70	1·22	1 83	83·25	14·59		30. Scottish Wholesale, Enniskillen.
31.	1·20	85·86	13·56	·68	1·33	84·43	13·73		31. Killyman.
32.	2·56	84·64	14·77	·77	1·21	83 25	12·39		32. Loughbrickland.
33.	1·25	85·60	14 29	·90	1·62	83·19	12·93		33. Finn Valley.
34.	2·16	85·10	12·27	·23	2·75	84·75	13·59		34. Munster Dairy School, Cork.
35.	·87	88·94	11·60	·30	1·13	86·97	10·23		35. Albert Farm, Glasnevin.
36.	1·41	84·23	14·00	1·51	·56	83 93	12·59		36. Ardagh.
37.	·67	84·63	14·16	·77	·86	84·21	–		37. Abbeydorney.
38.	1·48	80·72	13·54	1·05	·93	84·48	13·06		38. Mourne Abbey.
39.	1·45	83·21	13·90	·36	1·44	84·30	13·53		39. Rossmore.
40.	2·13	83·01	13·99	1·52	·48	84·01	–		40. Piltown Creamery.

APPENDIX XXX.—*continued.*

THE SOLUBLE

1901.

NAME of FARM, CREAMERY, or INSTITUTE.	May.		June.		July.		August.		September.		Octo
	Soluble.	Insoluble.	Soluble.	Insoluble.	Soluble.	Insoluble.	Soluble.	Insoluble.	Soluble.	Insoluble.	Soluble.
ENGLAND AND WALES:											
1. S. E. Agricultural College, Wye (18 samples)*	5·52 to 6·23	87·8 to 88·4	4·94 to 5·59	88·3 to 88·9	–		–	–		-	
2. Eastern Counties Dairy Institute, Ipswich	6·73	87·03	5·35	88·14	4·21	89·45	4·47	89·64	5·51	88·99	4·93
3. Mr. G. Taylor's Dairy, Whitlingham, Norwich.	4·83	89·46	4·92	89·32	4·41	89·09			4·15	90·01	4·70
4. Wrotham Park Farm, Barnet	5·77	88·35	5·47	88·15		88·66	5·67	88·33	5·90	88·42	5·44
5. Westmorland and Cumberland C. C. Farm, Newton Rigg, Penrith.	5·53	88·21	5·22	88·60	4·68	88·90	5·12	89·38	5·17	89·51	4·85
6. E. and W. Ridings C. C. Farm, Garforth, Leeds	5·34 5·61	89·12 88·82	5·97 5·50	87·38 89·18	4·99 4·59	88·13 88·94	4·67 4·47	89·43 89·64	4·78 4·13	89·53 89·67	3·82 3·77
7. Buscot Park Dairy, Faringdon	5·80	88·32	5·51	88·58	4·48	89·20	4·39	89·60	5·65	88·50	5·90
8. University College of North Wales, College Farm, Lledwigan, Llangefni, Anglesey.	5·21	89·26	5·30	88·48	5·11	88·31	4·56	89·08	5·15	89·35	4·63
9. Sharcombe, Wells, Somerset	5·62	88·50	5·55	88·85	4·69	89·03	5·48	89·21	5·36	89·16	4·67
10. Midland Dairy Institute, Kingston, Derby	5·71	88·73	5·76	88·01	3·76	90·34	4·31	89·76	4·16	90·00	4·49
11. Colonial College, Hollesley Bay, Suffolk	5·45 6·15	88·54 87·82	5·22 5·14	87·96 88·16	4·94 5·02	88·31 88·34	–		5·82	88·17	
12. Manor Farm, Gloucester	5·59	88·25	5·78	87·89	4·85	89·12	5·43	89·03	5·27	89·28	-
13. Carrick's Dairy, Cumberland	5·34	88·85	–	–	–		–	-		-	5·06
14. Somerset County Council Farm, Bickenhall, near Taunton.	5·62	88·24	6·03	87·55	4·60	89·09	4·91	89·23	5·59	88·48	5·06
SCOTLAND:											
15. Dunragit Creameries	5·64	88·40	5·47	88·30	5·31	88·83	4·93	88·98	4·83	89·19	4·55
16. Newton Farm, Glasgow			5·02	88·88	4·51	89·18	4·76	89·80	4·68	89·95	4·34
17. Wester Fowlis, Alford, Aberdeen	6·71	87·47	5·69	87·96	4·67	88·86	5·05	88·48	5·28	88·56	5·61
18. West of Scotland Agricultural College, Kilmarnock.	6·26	87·99	5·37	88·24	5·16.	88·76	5·07	88·81	5·47	88·43	-
19. Cogle Watten, Caithness, N.B.	6·27	87·00	6·79	86·91	5·49	88·29	5·25	88·53	5·32	88·83	5·04
20. Shinness, Lairg, Sutherland	5·88	87·57	5·73	87·24	5·55	87·67	5·39	88·39	5·55	88·87	4·89
21. Latheron Wheel, Caithness	5·20	88·38	5·69	87·76	5·49	88·09	5·50	88·18	5·01	89·35	4·39
22. Sanday Farm, Orkney Islands	5·13	88·11		-	5·13	88·54	5·32	88·90	5·03	89·72	5·19
23. Brora, Sutherland			5·82	87·50	5·08	88·69	5·35	88·17		-	
24. East Langwell, Rogart			5·12	88·27	5·49	87·61	5·39	88·43		-	5·51
25. Strathcroy, Sutherland		–	5·36	88·13	4·96	88·50	5·36	87·95	5·02	88·86	4·95
26. Gerinish, South Uist		–			5·62	88·54	5·40	88·34	–	-	5·36
27. Dremisdale, South Uist	–	-	5·30	88·12			5·73	87·99	5·42	88·84	5·43
28. Sumburgh Farm, Shetland Island	–	-			5·51	87·99	5·39	88·30	4·93	88·83	4·62
IRELAND:											
29. Aghadowey								–		–	5·15
30. Scottish Wholesale, Enniskillen	-	–	–	-	-	–		–		–	5·10
31. Killyman	–	–				-	–		–	-	5·11
32. Loughbrickland	–				-	–	–	–		–	4·75
33. Finn Valley		–		-	-	–	–		-	–	5·22
34. Munster Dairy School, Cork		–			–	–	–	–	–	–	5·10
35. Albert Farm, Glasnevin	–			–	–	–	–		–	–	-
36. Ardagh	-				-	-	–	–	5·32	88·85	-
37. Abbeydorney	–	–	–		–	–	-	–	5·15	89·11	5·05
38. Mourne Abbey	–		–			–			5·19	89·33	5·07
39. Rossmore	–	–		-		–			5·30	89·19	4·53
40. Piltown Creamery	–	–		–		–	–		5·39	89·39	4·69

* March, 1901 : Soluble, 4·77 to

APPENDIX XXX.—*continued.*

SOLUBLE ACIDS.

				1902										
ovember.		December.		January.		February.		March.		April.		May.		NAME of FARM, CREAMERY, or INSTITUTE.
	Insoluble.	Soluble.	Insoluble.	Soluble.	Insoluble.	Soluble.	Insoluble.	Soluble.	Insoluble.	Soluble.	Insoluble.	Soluble.	Insoluble.	
	–	–	–	–	–	–	–	–	–	–	–	–	–	1. S. E. Agricultural College, Wye, (18 samples).*
–	–	–	–	–	–	–		–	–	–	–	–	-	2. Eastern Counties Dairy Institute, Ipswich.
·89	88·70	6·03	89·61	5·92	88·15	5·77	-	6·15	88·71	5·35	89·29		-	3. Mr. G. Taylor's Dairy, Whitlingham, Norwich.
·33	88·85	5·57	88·28	5·52	88·15	5·87	87·35	5·56	87·74	5·95	86·79	-	-	4. Wrotham Park Farm, Barnet.
·25	90·24	5·81	97·86	5·87	88·21	5·11	88·38	5·65	88·37	5·25	88·55	-		5. Westmorland and Cumberland C. C. Farm, Newton Rigg, Penrith.
15 40	89·91 90·03	4·71 5·34	89·35 89·30	4·81 5·13	89·10 88·73	4·09 4·32	89·71 90·01	–	–	–	-	..		6. E. and W. Ridings C. C. Farm, Garforth, Leeds.
–	–	–	-	5·55	87·72	-	-	–	–	5·56	88·17	5·74	88·72	7. Buscot Park Dairy, Faringdon.
44	89·43	4·77	88·90	5·32	88·22	5·62	87·86	5·71	88·03	4·86	89·00		..	8. University College of North Wales, College Farm, Lledwigan, Llangefni, Anglesey.
·23	89·13	5·90	87·98	5·67	88·01	5·44	88·74	5·75	88·57	5·66	88·85	–	-	9. Sharcombe, Wells, Somerset.
·28	90·00	4·92	90·07	5·99	87·07	6·02	87·17	5·92	88·35	5·66	89·17	–		10. Midland Dairy Institute, Kingston, Derby.
·44	87·82	–	..	-	-	–	-	–	–	–		–	–	11. Colonial College, Hollesley Bay, Suffolk.
–	-	–		–	–		-	–		–		-	–	12. Manor Farm, Gloucester.
.	–	–	-		-	–		–	–	–	..	–	–	13. Carrick's Dairy, Cumberland.
36	89·60	5·33	88·10	5·69	87·90	4·98	88·97	5·07	89·36	.	-		-	14. Somerset County Council Farm, Bickenhall, near Taunton.
														SCOTLAND:
70	88·76	5·11	88·48	5·79	87·83	5·84	87·28	5·66	88·01	5·79	87·89	-	-	15. Dunragit Creameries.
21	89·60	5·54	–				–	–	–	–		–		16. Newton Farm, Glasgow.
02	–	–		5·82			–			–	–	–	-	17. Wester Fowlis, Alford, Aberdeen.
-	–	-	-		-	–	-	–	-	–		.	-	18. West of Scotland Agricultural College, Kilmarnock.
09	–	5·68	88·33	5·97	-	5·68	88·18	6·67	87·36	6·44			-	19. Cogle Watten, Caithness, N.B.
46	89·02	-	–		–	–	-	5·85	-	5·40	87·80	–	–	20. Shinness, Lairg, Sutherland.
28	89·69	5·58	87·70	5·28	88·02	5·44	88·47	6·44	86·62	6·19	87·50	–	–	21. Latheron Wheel, Caithness.
09	87·91	5·33	87·78	4·98	87·88		–	–		–	–	–	–	22. Sanday Farm, Orkney Islands.
	–	–	-			–	–	–	–	–	-	..	–	23. Brora, Sutherland.
	–	5·06	89·15	5·89	87·24	5·78	87·08	5·45	87·98	5·93	88·15	–	–	24. East Langwell, Rogart.
–	–	–	–	–	–	..	-	–				.	-	25. Strathcroy, Sutherland.
·81	89·50	..	–	–	–			–	-	.		–		26. Gerinish, South Uist.
84	88·36	5·46	89·35	5·15	88·57	6·04	87·60	6·00	87·15	5·02	88·39	–		27. Dremisdale, South Uist.
-	87·70	5·41	88·79		–	–	-	5·86	87·16	5·83	–	5·45	87·14	28. Sumburgh Farm, Shetland Island.
														IRELAND:
07	88·34	5·48	88·55	5·06	88·45	5·12	88·30	5·52	88·20	5·45	89·35	5·95	87·32	29. Aghadowey.
05	89·10	4·53	89·06	4·54	89·39	4·85	88·20	4·72	88·54	5·84	88·02	6·22	87·82	30. Scottish Wholesale, Enniskillen.
86	89·20	4·99	88·35	6·03	87·20	5·02	88·08	5·35	88·20	6·00	87·66	5·94	87·68	31. Killyman.
·75	89·07	5·25	87·98	5·70	88·20	5·23	39·08	5·68	88·59	6·10	88·44	5·60	87·72	32. Loughbrickland.
99	88·91	5·20	88·55	5·19	88·79	5·71	87·48	5·35	87·68	5·93	87·73	5·94	87·61	33. Finn Valley.
·41	88·89	3·99	90·27	5·56	88·00	5·56	88·48	5·06	88·12	5·62	88·43	6·22	87·93	34. Munster Dairy School, Cork.
·48	–	6·73	-	5·76	87·63	5·95	86·98	5·84	87·44	5·66	88·00	5·94	87·65	35. Albert Farm, Glasnevin.
·34	89·84	4·09	90·44	4·97	89·50	5·64	88·24	5·59	89·13		-	5·89	87·75	36. Ardagh.
·29	89·10	4·66	89·17		–	5·58	87·95	5·07	89·01	-	..	6·09	88·19	37. Abbeydorney.
·90	86·88	5·86	87·96	5·48	87·95	5·38	87·81	5·61	88·30		.	5·58	88·62	38. Mourne Abbey.
·48	89·63	4·52	89·96	4·81	89·21	4·95	88·39	5·68	88·28	–	–	6·17	87·61	39. Rossmore.
·62	89·45	4·76	89·52	–	–	5·44	88·90	5·00	88·73	–	–	6·26	87·78	40. Piltown Creamery.

soluble, 88·43 to 89·42.

Appendix XXX.

Appendix XXX.—*continued.*

The Mean Molecular Weight of Insoluble Acids of 330 Samples.

Name of Farm, Creamery or Institute.	1901.								1902.				
	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	Ma
England and Wales:													
1. S. E. Agricultural College, Wye (18 Samples*)	253·1 to 263·1	259·2 to 263·2	–	–	–			–	–	–	–		
2. Eastern Counties Dairy Institute, Ipswich	258·8	258·5	261·0	264·2	260·6	265·0	–			–			
3. Mr. G. Taylor's Dairy, Whitlingham, Norwich.	269·0	264·2	262·7		268·8	263·0	265·7	260·4	264·7		–	264·3	
4. Wrotham Park Farm, Barnet	269·0	257·2	257·9	260·1	257·2	257·8	257·9	265·8	267·8	255·8	261·8	256·4	
5. Westmorland and Cumberland C. C. Farm, Newton Rigg, Penrith.	267·5	256·9	265·4	266·0	265·9	268·2	267·1	264·7	267·1	265·1	–	258·1	
6. E. and W. Ridings C. C. Farm, Garforth, Leeds.	259·9 264·9	260·5 264·4	258·5 258·8	266·5 265·1	264·3 265·5	267·2 266·5	264·0 265·0	266·4 264·8	262·0 260·6	265·5 267·1	–	–	
7. Buscot Park Dairy, Faringdon	255·0	259·5	260·6	261·5	260·0	261·2			258·6	–	–		
8. University College of North Wales, College Farm, Lledwigan, Llangefni, Anglesey.	261·4	256·3	258·3	264·8	265·8	266·1	269·5	264·6	264·0	264·9	255·9	263·7	
9. Sharcombe, Wells, Somerset	260·2	263·0	261·4	262·3	262·5	262·1	263·4	266·1	264·9	266·4			
10. Midland Dairy Institute, Kingston, Derby	263·7	258·9	266·2	267·1	269·3	267·2	266·2	–	261·2	260·2	256·1	–	
11. Colonial College, Hollesley Bay, Suffolk	255·4 258·4	260·4 256·7	256·8 257·9		257·3	–	259·3	–	–	–	–	–	
12. Manor Farm, Gloucester	256·6	258·2	264·2	265·8	262·2	–		–	–	–	–	–	
13. Carrick's Dairy, Cumberland	258·1	–		–		259·8		–	–	–	–	–	
14. Somerset County Council Farm, Bickenhall, near Taunton.	259·1	257·8	262·0	264·9	262·5	268·7		256·7	259·8	265·0	–	–	
Scotland:													
15. Dunragit Creameries	258·7	254·5	261·7	262·7	262·4	265·6	260·5	258·5	262·8	263·3	–		
16. Newton Farm, Glasgow	–	263·1	264·1	268·0	267·3	266·3	264·8	260·1	–	–	–	–	
17. Wester Fowlis, Alford, Aberdeen	252·7	259·7	263·7	260·2	257·4	254·4		–	–	–	–	–	
18. West of Scotland Agricultural College, Kilmarnock.	253·6	256·7	258·2	259·2	258·2			–		–	–	–	
19. Cogle Watten, Caithness, N.B.	252·0	258·5	252·2	259·2	260·6	268·5	265·7	–	264·3	–	266·8	260·4	
20. Shinness, Lairg, Sutherland	255·7	251·3	254·1	261·3	258·0	261·9	263·6	–	–	–	255·6	257·5	
21. Latheron Wheel, Caithness	263·1	257·6	256·7	260·9	262·3	262·5	260·2	263·0	261·2		253·5	257·4	
22. Sanday Farm, Orkney Islands	253·7	260·1	263·9	263·2	258·9	254·2	254·6	258·1				–	
23. Brora, Sutherland	–	255·2	261·6	262·0	–					–	–	–	
24. East Langwell, Rogart	–	258·2	259·7	262·5		265·5	260·8	261·7	259·9	264·3	257·8	259·7	
25. Stratheroy, Sutherland	–	257·7	258·5	261·6	261·9	260·5	–	–			–		
26. Gerinish, South Uist		–	258·0	259·2	274·5	261·3		–		–			
27. Dremisdale, South Uist		252·1		255·7	258·8	260·0	262·8	264·9	264·8	260·7	259·8	263·5	
28. Sumburgh Farm, Shetland Island			253·4	258·0	257·6	259·8	–	264·7		–	–		
Ireland:													
29. Aghadowey						265·2	262·4	261·2	262·6	269·5	258·3		
30. Scottish Wholesale, Enniskillen						262·9	261·2	265·4	264·6	267·8	261·8	–	
31. Killyman		–				263·3	261·4	262·2	259·4	259·7	258·2	267·5	
32. Loughbrickland		–		–		264·8	260·9	258·1	258·1	–	–	–	
33. Finn Valley	–	–	–			263·2	260·6	259·8	260·0	260·5	259·7	261·3	
34. Munster Dairy School, Cork				–		265·1	268·8	266·8		258·0	261·5	259·3	
35. Albert Farm, Glasnevin				–		–	262·4	254·9	259·5	257·6	255·9	257·8	
36. Ardagh				–	261·0	–	266·2	268·1	262·6	264·2	265·0	–	
37. Abbeydorney					264·0	260·5	264·9	262·6		264·9	259·8		
38. Mourne Abbey					263·1	261·1	261·8	258·5	258·1	255·4	261·4	–	
39. Rossmore			–		262·5	262·6	259·6	265·6	262·8	259·0	260·5		
40. Piltown Creamery				–	263·7	264·4	268·9	265·7		262·9			

* In March 1901, 261·4 to 267·6

Appendix XXX.

Appendix XXX.—*continued.*

The Zeiss figure at 45° C. of 371 Samples.

Name of Farm, Creamery, or Institute.	1901. May.	June.	July.	August.	September.	October.	November.	December.	1902. January.	February.	March.	April.	May.
England and Wales:													
1. S. E. Agricultural College, Wye (18 samples)*	39·5 to 40·7	41·3 to 42·5		–		–		–	–	–	–	–	–
2. Eastern Counties Dairy Institute, Ipswich	40·1	41·0	42·3	41·9	40·9	41·7			–	–	–	–	–
3. Mr. G. Taylor's Dairy, Whitlingham, Norwich.	42·1	42·5	42·0	–	42·5	43·0	40·8	40·0	40·5	40·0	39·6	42·1	–
4. Wrotham Park Farm, Barnet	39·7	39·5	39·0	39·6	39·2	40·0	39·4	38·8	37·8	38·0	38·2	40·0	–
5. Westmorland and Cumberland C. C. Farm, Newton Rigg, Penrith.	40·1	41·0	42·1	42·2	41·1	42·2	42·0	39·6	39·5	39·3	40·0	41·4	–
6. E. and W. Ridings C. C. Farm, Garforth, Leeds.	41·2 41·6	42·0 42·0	41·1 41·1	42·0 42·0	42·0 42·0	43·4 42·8	41·3 41·7	40·6 40·2	40·0 39·3	40·8 40·3	–		–
7. Buscot Park Dairy, Faringdon	39·3	41·2	41·2	41·2	41·1	41·6			39·0	–	–	40·6	41·7
8. University College of North Wales, College Farm, Lledwigan, Llangefni, Anglesey.	40·9	41·0	40·3	42·0	42·0	42·8	41·9	40·7	39·9	40·1	39·2	41·5	
9. Sharcombe, Wells, Somerset	40·7	40·6	40·4	40·6	41·5	42·2	41·2	39·5	39·1	39·6	38·9	41·1	
Midland Dairy Institute, Kingston, Derby	41·5	41·2	42·1	42·5	42·0	42·8	41·0	41·6	39·0	39·1	39·1	41·0	–
Colonial College, Hollesley Bay, Suffolk	41·0 40·1	41·6 40·9	40·6 40·6	–	40·0	–	39·9			.		–	
Manor Farm, Gloucester	40·9	41·0	41·7	41·5	41·5	–	–	–	–	–	–	–	–
Carrick's Dairy, Cumberland	41·0	–		–		–	41·6	–	.		.		
Somerset County Council Farm, Bickenhall, near Taunton.	40·9	40·0	41·0	41·6	40·3	41·3	40·5	39·4	39·1	39·7	39·5	–	
Scotland:													
Dunragit Creameries	40·0	40·0	40·0	40·7	40·1	42·6	40·7	39·9	39·0	39·1	38·7	40·3	–
Newton Farm, Glasgow		41·1	41·5	42·0	41·9	43·2	41·2	38·9	–	–		–	
Wester Fowlis, Alford, Aberdeen	38·0	40·3	40·7	40·5	40·3	39·3	37·6	–	37·0			–	39·6
West of Scotland Agricultural College, Kilmarnock.	38·9	39·9	41·0	40·2	40·1					–			–
Cogle Watten, Caithness, N.B.	37·3	39·0	38·5	39·1	40·9	40·5	39·5	38·0	38·3	38·4	38·2	38·3	–
Shinness, Lairg, Sutherland	39·6	38·9	38·7	39·5	40·0	41·0	40·9	–		–	37·8	39·5	40·6
Latheron Wheel, Caithness	41·6	40·0	40·2	40·1	41·2	41·3	41·7	40·1	39·0	40·0	38·0	40·4	
Sanday Farm, Orkney Islands	39·3		40·7	41·0	41·9	40·0	38·4	38·4	38·8	–		–	
Brora, Sutherland	–	39·0	41·0	39·0		–			.			–	
East Langwell, Rogart		40·0	39·5	40·5	-	40·4	39·0	39·5	39·1	38·8	37·4	40·4	40·0
Strathcroy, Sutherland		39·9	40·1	39·8	40·8	40·6	–						-
Gerinish, South Uist			40·1	40·1	40·8	40·8	–	.			.		–
Drimisdale, South Uist	–	39·5	-	40·0	40·2	41·2	40·6	40·8	40·3	38·9	38·2	40·6	40·7
Sumburgh Farm, Shetland Island			40·0	40·0	41·4	41·3	–	38·0		.	40·2	39·2	40·1
Ireland:													
Aghadowey			.	–		41·8	41·7	39·8	39·5	39·0	39·0	41·8	41·0
Scottish Wholesale, Enniskillen						42·0	41·5	40·1	40·2	40·0	40·1	41·0	41·7
Killyman	–	–	–	–	.	41·8	41·5	39·7	38·2	39·1	38·9	40·8	41·4
Loughbrickland	-		–		.	41·9	41·4	38·4	39·4	38·9	40·7	40·5	41·2
Finn Valley		-			.	41·3	41·2	38·9	39·4	38·2	38·9	41·0	41·2
Munster Dairy School, Cork	–	–			.	42·0	41·8	41·4	40·1	40·0	40·0	40·8	41·2
Albert Farm, Glasnevin	–						39·1	37·7	39·1	38·1	38·3	39·8	41·0
Ardagh		-			41·0	42·0	41·7	41·6	39·9	59·6	41·5		41·5
Abbeydorney		-		–	41·8	42·2	41·2	40·9		40·0	39·2		41·7
Moarne Abbey		--	–		41·9	41·2	39·8	39·3	39·0	38·8	40·2		42·0
Rossmore		--		-	41·5	42·2	42·0	41·0	40·6	39·3	41·0		41·2
Piltown Creamery			–	–	41·6	42·2	41·3	41·0		40·0	39·5	-	41·6

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* In March 1901 40·8 to 41·8

Appendix XXX.

APPENDIX XXX.—*continued.*

The SPECIFIC GRAVITY (100°F.)

NAME OF FARM.	1901.				
	May.	June.	July.	August.	September.
ENGLAND AND WALES.					
1. S.E. Agricultural College, Wye (18 samples)*	912·48 to 913·40	911·46 to 912·44	–	–	–
2. Eastern Counties Dairy Institute, Ipswich	913·14	911·80	911·44	911·00	911·30
3. Mr. G. Tayior's Dairy, Whitlingham, Norwich.	911·44	911·56	911·24	–	910·44
4. Wrotham Park Farm, Barnet	911·82	911·92	911·60	911·71	911·78
5. Westmorland and Cumberland C. C. Farm, Newton Rigg, Penrith.	911·48	912·54	911·26	911·60	911·19
6. E. and W. Ridings C. C. Farm, Garforth, Leeds.	911·48 911·00	912·60 911·76	912·82 912·44	910·80 910·46	910·84 910·64
7. Buscot Park Dairy, Faringdon	912·42	912·80	911·50	911·08	912·18
8. University College of North Wales, College Farm, Lledwigan, Llangefni, Anglesey.	911·64	912·32	912·54	911·20	911·14
9. Sharcombe, Wells, Somerset	911·58	911·14	910·68	910·64	911·20
10. Midland Dairy Institute, Kingston, Derby	911·72	911·80	910·02	910·30	910·10
11. Colonial College, Hollesley Bay, Suffolk	913·24 913·12	912·61 912·66	912·24 912·20	–	– 912·36
12. Manor Farm, Gloucester	913·24	912·96	911·10	911·34	911·54
13. Carrick's Dairy, Cumberland	912·36	–	–	–	–
14. Somerset County Council Farm, Bickenhall, near Taunton.	912·46	911·88	910·84	911·02	911·96
SCOTLAND:					
15. Dunragit Creameries	911·72	912·36	912·30	911·30	910·94
16. Newton Farm, Glasgow		911·00	910·84	910·72	910·04
17. Wester Fowlis, Alford, Aberdeen	913·56	912·08	911·72	911·74	912·40
18. West of Scotland Agricultural College, Kilmarnock.	913·46	912·28	912·14	912·36	911·86
19. Cogle Watten, Caithness, N.B.	913·37	912·62	912·22	911·64	911·04
20. Shinness, Lairg, Sutherland	912·68	913·48	913·28	912·32	911·82
21. Latheron Wheel, Caithness	911·00	912·42	912·38	911·78	910·44
22. Sanday Farm, Orkney Islands	912·12	–	912·06	911·36	910·62
23. Brora, Sutherland	912·72	911·24	911·54	–	
24. East Langwell, Rogart	–	911·90	911·82	911·22	–
25. Strathcroy, Sutherland	–	911·62	911·20	912·00	911·20
26. Gerinish, South Uist	–	–	912·94	912·08	
27. Dremisdale, South Uist	–	–	913·18	913·24	912·30
28. Sumburgh Farm, Shetland Island	–	–	913·10	913·10	912·14
IRELAND:					
29. Aghadowey	–	–	–	–	–
30. Scottish Wholesale, Enniskillen	–	–	–	–	–
31. Killyman	–	–	–	–	
32. Loughbrickland		–	–	–	–
33. Finn Valley		–	–	–	–
34. Munster Dairy School, Cork	–	–	–		–
35. Albert Farm, Glasnevin		–	–	–	–
36. Ardagh	–	–	–	–	911·52
37. Abbeydorney		–	–	–	911·32
38. Mourne Abbey	–	–	–	–	911·30
39. Rossmore	–	–	–	–	911·20
40. Piltown Creamery	–	–	–	–	911·16

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* In March, 1901, 911·06 to 912·16.

APPENDIX XXX.—*continued.*

Appendix XXX.

of 361 samples.

1901—*continued.*			1902.					
October.	November.	December.	January.	February.	March.	April.	May.	
-	-	-	-				-	1.
910·70	-	-	-	-		-	-	2.
911·20	911·86	912·58	911·92	912·16	912·18	911·36	-	3.
911·22	911·62	911·60	912·00	912·22	911·30	911·84	-	4.
910·56	910·00	911·34	911·42	910·80	910·64	910·86		5.
909·72 909·34	909·96 910·36	910·90 910·80	911·18 911·22	909·82 909·66	-	-	-	6.
911·74	-	-	912·00	-	911·96	912·14	-	7.
911·10	910·00	910·84	911·84	911·62	911·20	910·74	-	8.
911·10	912·30	911·14	910·96	910·54	911·16	910·86	-	9.
910·06	910·08	910·18	912·58	912·00	911·88	911·66	-	10.
912·14		-		-		-		11.
		-			-	-	-	12.
912·30	-		-				-	13.
910·66	910·12	911·80	911·68	910·30	910·16		-	14.
911·04	911·18	911·46	911·62	911·82	911·88	911·74	-	15.
910·58	910·04	911·06						16.
912·36	912·64		913·38				912·70	17.
								18.
910·50	912·24	911·52	911·66	911·40	912·02	913·04		19.
911·20	910·56	-	-		912·76	912·22	912·34	20.
910·68	909·35	912·72	912·00	911·22	913·28	912·68	-	21.
911·42	912·10	912·02	911·72					22.
-				-	-	-	-	23.
911·00	911·23	910·32	911·76	911·22	912·06	910·58	911·48	24.
910·56	-	-			-		-	25.
912·10	911·36	-	-	-	-			26.
911·92	911·16	910·52	911·40	912·42	912·12	911·38	911·16	27.
911·76		912·50			912·10	912·56	912·02	28.
911·80	911·38	911·78	911·08	911·00	911·30	911·16	912·46	29.
911·48	911·88	910·40	910·74	910·70	912·02	911·28	912·54	30.
911·56	911·30	911·50	911·94	911·44	911·64	912·06	912·68	31.
911·02	911·34	911·76	911·90	911·48	911·80	911·94	912·64	32.
911·48	911·26	911·52	911·08	911·60	911·16	911·78	912·30	33.
911·28	911·00	909·72	911·32	911·40	911·38	911·54	912·58	34
	913·08	913·60	912·36	912·98	912·92	912·20	911·64	35.
911·72	910·76	909·92	910·80	911·22	911·60		912·84	36.
911·46	910·84	910·88	-	911·58	911·66		912·62	37.
911·88	912·30	911·56	912·00	912·08	912·16	-	911·96	38.
911·12	910·92	909·90	910·58	911·50	911·90	-	913·14	39.
910·96	910·62	910·58	-	911·02	911·60	-	912·60	40.

Appendix XXX.

APPENDIX XXX.—*continued.*

The KOETTSTÖRFER Number of 347 samples.

NAME of FARM, CREAMERY, or INSTITUTE.	1901.								1902.			
	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.
ENGLAND AND WALES:												
1. S. E. Agricultural College, Wye (18 samples)*	238·0 to 244·8	243·2 to 249·2	–	–	–	–	–	–			–	
2. Eastern Counties Dairy Institute, Ipswich	238·6?	242·3	248·8	252·0	248·7	256·6	–	–	–		–	
3. Mr. G. Taylor's Dairy, Whitingham, Norwich.	250·4	249·8	250·1	–	255·1	252·7	245·1	246·0	245·6	243·6	243·1	249·0
4. Wrotham Park Farm, Barnet	243·8	241·1	240·7		244·3	247·7	238·1	247·9	240·2	238·5	244·8	242·7
5. Westmorland and Cumberland C. C. Farm, Newton Rigg, Penrith.	245·6	243·0	250·1	249·4	253·6	254·8	254·3	246·5	245·8	248·4	248·6	251·7
6. E. and W. Ridings C. C. Farm, Garforth, Leeds.	249·4 252·1	245·2 246·6	243·9 245·7	251·7 252·3	254·1 252·7	259·7 260·0	251·7 248·9	247·3 251·7	246·1 246·0	255·1 253·6	– –	–
7. Buscot Park Dairy, Faringdon	242·3	242·9	247·6	248·0	247·7	250·5	–		244·0	–	–	243·7
8. University College of North Wales, College Farm, Lledwigan, Llangefni, Anglesey.	248·6	242·4	241·9	251·1	251·6	253·3	249·5	244·5	245·3	247·0	244·8	250·8
9. Sharcombe, Wells, Somerset	247·6	244·9	247·4	249·1	250·7	251·5	242·6	248·6	246·5	247·5	244·5	247·6
10. Midland Dairy Institute, Kingston, Derby	248·7	245·0	255·4	257·0	256·6	256·6	255·6	253·8	240·1	240·2	244·7	246·4
11. Colonial College, Hollesley Bay, Suffolk	242·6 241·9	244·2 243·5	243·9 245·7	–	243·5	–	242·2	–	–	–	–	–
12. Manor Farm, Gloucester	242·8	241·3	249·5	–	251·4	–	–	–	–	–	–	–
13. Carrick's Dairy, Cumberland	246·3	–	–			248·7	–	–	–	–	–	–
14. Somerset County Council Farm, Bickenhall, near Taunton.	245·2	244·0	248·5	–	247·6	251·9	250·2	245·2	247·7	250·0	249·2	
SCOTLAND:												
15. Dunragit Creameries	247·0	241·0	242·0	247·3	248·8	253·2	247·1	245·5	237·1	243·4	243·2	244·8
16. Newton Farm, Glasgow		249·8	249·8	–	256·5	258·2	252·2	251·3	–	–		
17. Wester Fowlis, Alford, Aberdeen	233·9	244·7	245·8	247·3	243·2	246·4	240·1	–	236·3		–	
18. West of Scotland Agricultural College, Kilmarnock.	249·5	244·3	242·3	–	245·3		–	–			–	
19. Cogle Watten, Caithness, N.B.	235·0	238·0	238·3	–	247·6	252·4	244·3	240·9	241·7	243·8		241·4
20. Shinness, Lairg, Sutherland	243·8	240·3	238·4	244·7	245·0	253·1	250·2		–		237·0	247·0
21. Latheron Wheel, Caithness	251·9	239·5	241·6	246·6	252·9	256·0	259·8	243·0	247·0		236·0	244·4
22. Sanday Farm, Orkney Islands	241·6	–	245·3	250·2	254·0	240·7	242·6	242·8	244·6	–		
23. Brora, Sutherland	–	241·3	246·6	244·8	–	–	–	–	–	–	–	
24. East Langwell, Rogart		244·7	244·5	249·2	–	249·3	245·7	248·9	243·7	245·4	242·7	249·1
25. Strathcroy, Sutherland		242·7	245·3	245·6	250·7	243·4				–	–	–
26. Gerinish, South Uist	–	–	240·1	244·4	247·1	246·7				–		–
27. Dremisdale, South Uist	–	239·7	–	239·0	245·9	247·2	253·0	256·4	249·6	241·3	242·8	248·5
28. Sumburgh Farm, Shetland Island			239·0	239·8	248·6	252·0	–	238·1	–	–	243·1	246·
IRELAND:												
29. Aghadowey					–	249·1	254·2	245·9	245·1	243·6	247·2	247·0
30. Scottish Wholesale, Enniskillen			–			249·7	249·0	248·1	249·4	250·1	249·6	246·1
31. Killyman		–	–			250·1	248·4	244·7	241·4	244·7	246·4	245·2
32. Loughbrickland			–			252·0	249·5	240·7	242·5	243·6	245·3	244·1
33. Finn Valley			–		–	249·3	249·8	245·0	248·1	243·8	245·8	247·3
34. Munster Dairy School, Cork						255·4	249·6	254·0	248·4	247·1	247·0	248·2
35. Albert Farm, Glasnevin		–	–	–	–	–	240·2	235·3	–	240·9	239·5	242·1
36. Ardagh					248·4		255·1	254·8	249·5	248·6	245·6	–
37. Abbeydorney					251·5	254·4	255·1	247·2		244·9	245·3	
38. Mourne Abbey		–			250·2	253·0	251·0	242·1	243·5	241·7	243·4	
39. Rossmore		–	–	–	250·4	254·7	252·7	252·6	250·0	246·3	245·9	
40. Piltown Creamery		–	–	–	251·3	256·9	254·0	251·6	–	249·8	245·7	

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* In March 1901, 244· to 250·7.

Appendix XXXI.

APPENDIX XXXI.

Handed in by Mr. Lewin, Q. 10662–8.

Results obtained in Government Laboratory from Russian (including Siberian) Butter.

Month when made.	Specific Gravity.	Reichert-Wollny No.	Zeiss at 45°.	Source.
December	911·86	25·4	39·2	Siberia.
"	911·50	24·6	39·4	"
July	911·98	27·6	41·0	Russia.
"	911·90	27·4	41·0	"
"	911·06	25·7	41·9	"
"	911·00	27·6	42·0	"
February	910·58	24·5	39·6	West Siberia.
"	912·38	30·5	38·4	Russia.
"	911·14	27·6	39·8	"
"	912·22	29·4	41·0	Northern Russia.
"	911·32	27·1	41·7	" "
"	911·94	29·1	41·2	" "
"	911·40	26·2	40·8	Siberia.
"	911·52	27·0	40·1	"
"	912·04	27·0	39·7	"
"	911·54	27·4	40·2	"
"	911·70	26·4	40·6	"
"	911·48	25·2	40·5	"
"	911·54	27·7	40·4	"
"	911·72	26·5	40·1	"

App. xxxii.

Table I. (A).

APPENDIX,

(Supplied by

> *Note.—In the following Tables the term "collected" indicates "co-operative" milk; and "cream butter" means butter made from "sweet cream."*

TABLE

Results of Analyses of Samples of Butter

A.—Analyses made in the Bacteriological

No.	Government and District.	Village or Farm.	"Farm" or "Collected" Milk.	Food.	Date of Butter-making.	Brand of Butter.	Was Cream Pasteurised?
					1901:		
1	Vologda, Griagov	Zurievo	Farm	Plentiful, dry	20 October	Paris	Yes
1a	Yaroslav, Poshekhon	Yashkanovo	Collected	,, ,,	19 October	Export	No
2	Vologda, Griazov	Botalovo	Farm	Ordinary	24 October	Paris	Yes
3	Vologda, Griazov	Alexino	Collected	,,	23 October	Export	No
4	Vologda, Griazov	Golovinska	,,	Scanty, marshy	25 October	Paris	Yes
5	Moguilev, Sienin	Bielitza	Farm	—	18 October	Cream	No
5a	Moguilev, Ozshansk	Zarechie	,,	—	5 October	,,	,,
6	Moguilev, Rogachev	Diedlovo	,,	—	23 October	,,	,,
7	Moguilev, Moguilev	Krugloe	,,	—	28 September	,,	,,
8	Moguilev, Rogachev	Ostermansk	,,	—	20 October	,,	,,
9	Moguilev, Gomelsk	Durovichi	,,	—	End June	Export	,,
10	Moguilev, Rogachev	Diedlovo	,,	—	Middle June	,,	,,
11	Moguilev, Moguilev	Krugloe	,,	—	Middle July	,,	,,
12	Moguilev, Rogachev	Ostermansk	,,	—	Middle June	,,	,,
13	Moguilev, Sieninsk	Bielitza	,,	—	Beginning June	,,	,,
14	Vologda, Griazov	Silino	,,	—	27 October	Paris	Yes
15	Yaroslav, Roman	Tanarovo	,,	—	1 November	,,	,,
16	Yaroslav, Poshekhon	Ashkemovo	Collected	Plentiful	1 November	Export	No
17	Yaroslav, Roman	Lytarovo	Farm	Ordinary	26, 28, 30 Oct.	,,	,,
18	Moguilev, Orshansk	Zarechie	,,	—	25 October	Cream	,,
19	Moguilev, Gotnel	Durovichi	,,	—	26 October	,,	,,
20	Moguilev, Moguil	Krugloe	,,	—	27 October	,,	,,
21	Moguilev, Siening	Bielitza	,,	—	25 October	,,	,,
22	Moguilev, Chausk	Zhdanovichi	,,	—	Middle June	Export	,,
23	Vologda, Griaz	Botalovo	,,	Ordinary	3 November	Paris	Yes
24	Vologda, Griaz	Alexino	Collected	,,	3 November	,,	,,
25	Vologda, Griaz	Golovinsk	,,	Scanty, marshy	2 November	,,	,,
26	Yaroslavl, Roman	Khorpaevo	,,	Plentiful, dry	4 November	,,	,,
27	Yaroslavl, Roman	Alexievsk	Farm	,, ,,	15, 18 August	Export	No
28	Vologda, Griazov	Silino	,,	Scanty, marshy	5 November	Paris	Yes
29	Yaroslav, Lubimsk	Martianovo	Collected	,, ,,	6 November	,,	,,
30	Yaroslav, Poshekhon	Yaskanovo	,,	Plentiful, dry	6 November	Export	No
31	Yaroslav, Lubimsk	Buzheninova	,,	Ordinary	8 November	Paris	Yes
32	Moguilev, Rogach	Diedlovo	Farm	—	2 November	Cream	No
33	Moguilev, Rogach	Ostermansk	,,	—	3 November	,,	,,

App. xxxii.
Table I. (A).

XXXII.

the Russian Government.)

I.

COLLECTED BY GOVERNMENT DAIRY INSTRUCTORS.

LABORATORY OF THE MINISTRY OF AGRICULTURE.

Water.	Ash.	Fat.	Refraction. Zeiss.	Melting Point.	Acidity.	Reichert-Wollny No.	No.
Per Cent.	Per Cent.	Per Cent.		Degrees, C.			
12·329	0·64	86·721	43·1	32·0	1·4	—	1
11·43	1·3	85·55	42·7	32·0	2·7	—	1a
10·6	0·89	87·5	43·6	33·0	3·8	—	2
10·625	1·01	86·89	43·6	33·0	2 1	—	3
12 17	1·0	85·98	43·2	32·0	10·5	—	4
12·2	0·67	86·71	43·2	32·0	2·2	—	5
11·46	0·92	86·44	44·2	33·0	4·6	—	5a
12·10	0·69	86·38	43·7	31·0	9·8	—	6
11·11	0·82	87·81	42·6	34·0	8·8	—	7
13·17	0·49	85·11	42·9	32·0	2·4	—	8
13·9	0·78	85·17	43·7	33·0	3·3	—	9
13·92	1·17	84·19	43·2	32·5	2·7	—	10
12·99	1·69	86·1	43·6	32·5	1·7	—	11
13·19	1·66	84·72	42·9	31·0	3·6	—	12
12·3	0·82	85·77	45·1	34·0	4·2	—	13
11·75	0·61	87·12	43·5	33·5	2·3	—	14
10·83	0·59	88·32	43·7	33·0	6·7	—	15
13·19	0·79	85·3	43·5	33·0	9·2	—	16
11·92	0·92	87·22	44·0	32·0	10·9	—	17
10·69	0·79	88·31	44·5	32·0	6·8	—	18
13·07	0·81	86·35	43·2	33·0	11·3	—	19
11·55	0·67	87·25	43·6	33·0	5·0	—	20
13·5	0·6	85·93	42·8	34·0	5·8	—	21
11·722	1·19	86·57	42·8	33·0	5·2	—	22
11·707	0·76	86·63	43·0	33·5	17·0	—	23
10·65	0·65	87·95	44·1	34·0	10·8	—	24
12·14	0·73	85·89	44·8	33·0	12·8	—	25
12·115	0·65	85·97	42·9	35·5	6·7	—	26
12·0	1·49	85·21	43·1	32·0	8·8	—	27
11·25	0·95	86·32	43·9	32·0	2·7	—	28
11·18	0·77	86 77	42·4	32·5	3 2	—	29
13·72	1·14	83·73	43·0	34·0	2·0	—	30
11·35	0·68	87·33	44·5	34·0	10·9	23·04	31
11·37	0·71	87·21	43·6	33·0	11·3	24·31	32
13·0	0 76	85·31	48·8	33·0	8·1	22·98	33

App. xxxii.
Table I. (A).

A.—ANALYSES made in the Bacteriological

No.	Government and District.	Village or Farm.	"Farm" or "Collected" Milk.	Food.	Date of Butter-making.	Brand of Butter.	Was Cream Pasteurised?
					1901:		
34	Vologda, Griazov	Botalovo	Farm	Ordinary	10 November	Paris	Yes
35	Moguilev, Orshan	Zarechil	,,	—	30 October	Cream	No
36	Moguilev, Mogull	Golovshchina	,,	—	1 November	,,	,,
37	Vologda, Griazov	Alexino	Collected	Ordinary	10 November	Paris	Yes
38	Moguilev, Gomels	Dursvichi	Farm	—	3 November	Cream	No
39	Moguilev, Rogach	Diedlovo	,,	—	5 November	,,	,,
40	Moguilev, Rogach	Ostermansk	,,	—	7 November	,,	,,
41	Moguilev, Sieninsk	Bielitza	,,	—	11 November	,,	,,
42	Yaroslav, Roman	Lytarevo	,,	Ordinary	12 November	Paris	Yes
43	Yaroslav, Roman	Tamarovo	,,	Scanty, marshy	12 November	,,	,,
44	Vologda, Griazov	Silino	,,	,, ,,	12 November	,,	,,
45	Vologda, Griazov	Golovinskoe	Collected	,, ,,	11 November	,,	,,
46	Yaroslav, Lubimsk	Buzenilova	,,	Ordinary	15 November	,,	,,
47		Not analysed	—	—	Mould	—	—
48	Yaroslav, Roman	Khorpaevo	Collected	Plentiful, dry	16 November	Paris	Yes
48A	Moguilev, Moguil	Golovshchina	Farm	—	14 November	—	—
48B	Moguilev, Gomel	Durovichi	,,	—	15 November	—	—
49	Yaroslav, Roman	Alexeevska	,,	—	17 November	Paris	Yes
50 51		Not analysed	—	—	Mould	—	—
52	Vologda, Griazov	Golovinskol	Collected	Scanty, marshy	20 November	Paris	Yes
53		Not analysed	—	—	Mould	—	
54	Yaroslav, Roman	Tamarovo	Farm	—	19 November	Paris	Yes
54A		Not analysed	—	—	Mould	—	—
55	Yaroslav, Poshekon	Yashkanovo	Collected	Plentiful, dry	20 November	Export	No
56		Not analysed	—	—	Mould	—	—
57	Yaroslav, Romansk	Alexeevskoe	Farm	Plentiful, dry	22 November	Paris	Yes
58	Moguilev, Orshans	Zarechie	,,	—	18 November	Cream	No
59	Moguilev, Gometsk	Durovichi	,,	—	18 November	,,	,,
60	Moguilev, Sieninsk	Bielitza	,,	—	20 November	,,	,,
61	Moguilev, Moguilev	Golovschina	,,	—	20 November	,,	,,
62	Moguilev, Rogachev	Diedlovo	,,	—	23 November	,,	,,
63	Moguilev, Rogachev	Ostermansk	,,	—	23 November	Paris	Yes
64	Yaroslav, Lubimsk	Buzheninovo	Collected	Ordinary	25 November	,,	,,
65	Yaroslav, Lubimsk	Martianovo	,,	Scanty, marshy	25 November	,,	,,
66		Not analysed	—	—	Mould	—	—
67	Vologda, Griazov	Golovinskoe	Collected	Ordinary	29 November	Paris	Yes
68	Vologda, Griazov	Alexino	,,	—	29 November	,,	,,
69		Not analysed	—	—	Mould	—	—
70	Yaroslav, Poshekhon	Yaskanovo	Collected	Plentiful, dry	1 December	Export	Yes
71	Yaroslav, Poshekhon	,,	,,		3 December	,,	No

XXXII.—*continued.*

App. xxxii. Table I. (A).

Laboratory of the Ministry of Agriculture—*continued.*

Water.	Ash.	Fat.	Refraction. Zeiss.	Melting Point.	Acidity.	Reichert-Wollny No.	No.
Per Cent.	Per Cent.	Per Cent.		Degrees, C.			
9·36	0·23	88·97	44·0	32·0	4·0	22·67	34
10·7	0·57	87·59	43·6	33·0	1·2	23·5	35
11·13	0·6	86·51	42·8	33·5	9·5	26·0	36
12·57	0·97	85·7	43·6	33·5	4·3	25·41	37
11·47	0·66	86·39	42·9	34·0	1·4	22·11	38
11·53	0·73	86·88	43·0	32·5	3·8	23·13	39
10·49	0·84	87·3	43·9	32·0	2·5	23·12	40
11·89	0·27	86·7	43·2	29·0	5·3	23·89	41
11·59	0·53	86·3	43·8	31·5	8·1	24·67	42
15·7	0·71	82·11	43·6	31·5	1·2	26·9	43
13·68	0·88	84·72	43·7	32·0	1·0	26·12	44
11·5	0·79	86·9	42·9	32·0	5·7	26·53	45
11·19	0·78	86·42	43·2	33·5	3·4	24·71	46
—	—	—	—	—	—	—	47
8·69	0·54	88·97	43·6	—	4·7	21·78	48
13·87	0·62	85·1	44·0	—	2·1	26·07	48A
13·21	0·75	85·3	43·2	—	7·0	25·3	48B
15·57	1·27	82·1	44·0	—	2·1	26·07	49
—	—	—	—	—	—	—	50 51
13·35	0·37	85·75	44·1	—	1·7	23·87	52
—	—	—	—	—	—	—	53
13·23	0·89	84·72	44·8	—	4·9	23·98	54
—	—	—	—	—	—	—	54A
12·70	1·3	87·21	43·8	—	3·8	26·64	55
—	—	—	—	—	—	—	56
15·18	0·67	82·7	43·9	—	8·4	22·0	57
10·85	0·67	86·93	44·0	—	1·9	—	58
12·98	0·99	84·57	43·1	31·5	4·8	—	59
14·67	0·85	82·89	44·0	—	1·3	23·7	60
12·59	0·59	85·2	43·9	—	7·4	26·51	61
13·04	0·65	85·39	43·5	—	4·2	26·41	62
13·76	0·81	84·53	43·6	32·5	1·8	23·32	63
13·92	1·03	83·251	44·2	—	2·1	26·31	64
13·34	0·79	84·71	43·8	—	1·6	26·74	65
—	—	—	—	—	—	—	66
11·91	0·93	85·12	43·4	—	2·9	26·18	67
9·53	0·7	87·7	43·6	—	33·0	26·74	68
—	—	—	—	—	—	—	69
11·93	1·35	85·72	44·2	33·0	3·9	23·98	70
16·0	0·98	80·4	45·1	—	2·7	22·0	71

App. xxxii.
Table I. (A).

APPENDIX,

A.—ANALYSES made in the Bacteriological

No.	Government and District.	Village or Farm.	"Farm" or "Collected" Milk.	Food.	Date of Butter-making.	Brand of Butter.	Was Cream Pasteurised?
					1901:		
72	Vologda, Gliazov	Silino	Farm	Scanty, marshy	4 December	Paris	Yes
73	Vologda, Gliazov	Batalovo	,,	Ordinary	5 December	,,	,,
74		Not analysed	—	—	Mould	—	—
75	Yaroslav, Roman	Lytarevo	Farm	Ordinary	6 December	Export	No
76	Vologda, Griazov	Golovinskoe	Collected	Scanty, marshy	7 December	Paris	Yes
77	Yaroslav, Roman	Tamarovo	Farm	,, ,,	7 December	,,	,,
78		Not analysed	—	—	Mould	—	—
79	Yaroslav, Lubim	Bugeninovo	Collected	Ordinary	3 December	Paris	Yes
80		Not analysed	—	—	Mould	—	—
81	Yaroslav, Poshekhon	Yashkanovo	Collected	Plentiful, dry	18 December	Export	No
82		Not analysed	—	—	Mould	—	—
83	Vologda, Griazov	Golovinskoe	Collected	Scanty, marshy	20 December	Paris	Yes
84		Not analysed	—	—	Mould	—	—
85*	Snersk, Co-operative Dairy.	—	Collected	—	—	—	—
86*	Snersk, Co-operative Dairy.	—	—	—	—	—	—
87*	Snersk, Co-operative Dairy.	—	Collected	—	—	—	—
88*	Snersk, Co-operative Dairy.	—	,,	—	—	—	—
89*	Snersk, Co-operative Dairy.	—	,,	—	—	—	—
90*	Snersk, Co-operative Dairy.	—	,,	—	—	—	—
91*	Tobolsk	—	,,	—	13 November	—	—
92*	Mitinsk, Co-operative Dairy.	—	—	—	24 November	—	—
93*	Mitinsk, Co-operative Dairy.	—	—	—	27 November	—	—
94*	Mitinsk, Co-operative Dairy.	—	—	—	30 November	—	—
95*	Mitinsk, Co-operative Dairy.	—	—	—	20 December	—	—
96*	Mitinsk, Co-operative Dairy.	—	—	—	12 December	—	—
97*	Mitinsk, Co-operative Dairy.	—	—	—	14 December	—	—
98	Moguilev, Moguilev	Golovshchina	Farm	—	11 December	—	—
99	Moguilev	Skrynshchina	,,	—	14 December	—	—
100		Not analysed	—	—	Mould	—	—
101							
102	Moguilev, Chausk	Shdanovichi	Farm	—	18 December	—	—
103	Moguilev, Moguilev	Golovchin	,,	—	18 December	—	—
104	Moguilev	Skrynshchina	,,	—	21 December	—	—
105	Moguilev	Tolochina	,,	—	21 December	—	—
106	Moguilev, Chausk	Zhdanovichi	,,	—	—	—	—
107	Moguilev	Skrynshchina	,,	—	—	—	—
108	Moguilev	Tolochina	,,	—	28 December	—	—
109		Not analysed	—	—	Mould	—	—
110	Moguilev, Moguil	Tolovchin	Farm	—	—	—	—
111	Moguilev	,,	,,	—	—	—	—

* Siberian samples.

XXXII.—*continued.*

App. xxxii.
Table I. (A).

Laboratory of the Ministry of Agriculture—*continued.*

Water.	Ash.	Fat.	Refraction. Zeiss.	Melting Point.	Acidity.	Reichert-Wollny No.	No.
Per Cent.	Per Cent.	Per Cent.		Degrees, C.			
12·87	0·87	85·31	44·7	32·0	2·9	25·3	72
11·88	0·63	85·97	44·6	32·5	6·1	24·64	73
—	—	—	—	—	—	—	74
13·62	1·72	83·93	43·2	33·0	2·2	24·10	75
12·10	0·84	85·21	43·6	—	2·7	25·3	76
11·27	0·79	86·54	43·7	28·5	3·1	25·57	77
—	—	—	—	—	—	—	78
13·5	0·98	84·2	44·0	32·0	1·2	26·98	79
—	—	—	—	—	—	—	80
13·07	1·3	84·1	43·2	—	7·2	—	81
—	—	—	—	—	—	—	82
12·67	1·01	84·93	43·5	—	16·7	—	83
—	—	—	—	—	—		84
11·59	1·7	86·11	43·5	—	8·3	24·86	85*
15·54	1·21	82·13	43·0	—	6·6	25·57	86*
12·48	0·93	85·31	42·9	—	3·0	26·65	87*
13·11	0·99	85·71	43·1	—	7·1	25·7	88*
13·45	1·02	84·6	43·1	—	8·0	24·71	89*
13·71	0·7	84·8	43·2	—	2·7	25·6	90*
15·16	1·1	82·3	43·9	—	7·2	25·0	91*
11·11	0·9	87·8	44·0	31·0	4·8	24·7	92*
12·57	1·3	85·3	43·8	32·0	7·0	26·51	93*
11·5	1·21	86·8	43·1	32·0	2·0	23·89	94*
10·7	1·2	87·7	43·6	33·0	1·5	25·7	95*
13·2	0·7	85·4	42·8	32·0	7·3	24·8	96*
14·3	0·75	83·9	42·3	33·0	2·1	25·41	97*
13·6	0·5	85·3	42·1	32·0	1·4	23·5	98
15·57	0·37	82·31	44·5	32·5	2·7	21·85	99
—	—	—	—	—	—	—	100 101
13·24	0·67	84·69	44·8	32·0	5·9	23·99	102
12·16	0·6	85·87	43·1	31·0	7·0	23·84	103
10·69	0·53	88·2	42·1	—	2·2	23·0	104
12·30	0·42	85·7	43·1	—	2·9	24·66	105
11·7	0·39	86·8	42·5	—	8·3	23·9	106
15·6	0·89	82·3	43·1	—	1·2	23·18	107
12·9	0·66	84·51	42·5	—	4·8	23·8	108
—	—	—	—	—	—	—	109
11·5	0·71	86·7	43·0	—	8·2	24·6	110
13·15	0·67	85·4	42·5	—	2·2	24·8	111

* Siberian samples.

A.—ANALYSES made in the Bacteriological

No.	Government and District.	Village or Farm.	"Farm" or "Collected" Milk.	Food.	Date of Butter-making.	Grand of Butter.	Was Cream Pasteurised?
					1902.		
112	Moguilev, Thausk	Zhdanovichi	Farm	—	1 January	—	—
113	Yaroslav, Poshekh	Yashkanovo	Collected	Plentiful, dry	2 January	Export	No
114	Vologda, Griazov	Shilino	Farm	Scanty, marshy	2 January	Paris	Yes
115	Vologda, Griazov	Botalovo	,,	Ordinary	3 January	,,	,,
116	Vologda, Griazov	Alexino	Collected	,,	3 January	Export	No
117	Vologda, Griazov	Golovinsk	,,	Scanty, marshy	4 January	Paris	Yes
118	Moguilev	Skrynshchina	Farm	—	4 January	—	—
119		Not analysed	—	—	Mould	—	—
120	Yaroslav, Romanov	Khomutof	Collected	Ordinary	5 January	Export	No
121	Yaroslav, Romanov	Alexeevskaja	,,	Plentiful, dry	6 January	,,	,,
122	Yaroslav, Lubimsk	Bugeninovo	,,	Ordinary	8 January	Paris	Yes
123	Yaroslav, Romanov	Khorpaevo	,,	Plentiful, dry	5 January	,,	,,
124	Yaroslav, Romanov	Taramorovo	Farm	Scanty, marshy	3 January	,,	,,
125	Moguilev, Chausk	Zhdanovichi	,,	—	7 January	—	—
126		Not analysed	—	—	Mould	—	—
127	Moguilev	Skrynshchina	Farm	—	11 January	—	—
128	Moguilev, Moguil	Golovchin	,,	—	15 January	—	—
129	Vologda, Griazov	—	,,	Ordinary	—	—	—
130	Vologda, Griazov	—	Collected	—	17 January	—	—
131	Moguilev, Chausk	Zhdanovichi	Farm	—	14 January	—	—
132	Moguilev	Skrynshchina	,,	—	18 January	—	—
133		Not analysed	—	—	Mould	—	—
134	Moguilev, Chausk	Zhdanovichi	Farm	—	21 January		
135	Yaroslav, Roman	Lytarevo	,,	Ordinary	19 January	Export	No
136	Yaroslav, Lubimsk	Martianovo	Collected	Scanty, marshy	21 January	Paris	Yes
137	Yaroslav, Romanov	Alexeevska	Farm	Plentiful, dry	20 January	Export	No
138	Yaroslav, Lubimsk	Bugeninovo	Collected	Ordinary	23 January	Paris	Yes
139	Moguilev, Moguil	Golovchin	Farm	—	22 January	—	—
140	Moguilev	Tolochin	,,	—	25 January	—	—
141	Moguilev	Skrynshchina	,,	—	25 January		—
142	Yaroslav, Roman	Tamarovo	,,	Scanty, marshy	19 January	Paris	Yes
143		Not analysed	—	—	Mould	—	—
144	Moguilev, Moguilev	Golovchin	Farm	—	27 January	—	—
145	Moguilev, Chausk	Zhdanovichi	,,	—	29 January	—	—
146	Vologda, Griazov	Alexino V.	Collected	Ordinary	1 February	Export	No
147*	Tomsk, Kainsk	Alexandrin	,,	,,	1 February	—	—
148*	Tomsk, Kainsk	Agricultural Dairy.	Farm and collected.	,,	—	—	—
149*	Tomsk, Kainsk	,, ,,	,,	,,	—	—	—
150*	Tomsk, Kainsk	,, ,,	,,	,,	—	—	—
151*	Tomsk, Kainsk	,, ,,	,,	,,	—	—	—

* Siberian samples.

XXXII.—*continued.*

Laboratory of the Ministry of Agriculture—*continued.*

Water.	Ash.	Fat.	Refraction. Zeiss.	Melting Point.	Acidity.	Reichert-Wollny No.	No.
Per Cent.	Per Cent.	Per Cent.		Degrees, C.			
11·9	0·62	86·31	43·0	—	7·5	23·98	112
11·35	0·7	86·7	42·0	—	1·5	23·08	113
13·08	0·51	86·51	43·1	—	2·0	21·89	114
13·35	0·73	84·52	43·6	—	1·7	26·3	115
16·2	0·29	81·7	44·2	—	7·3	24·6	116
11·28	0·35	86·3	44·0	—	1·5	24·7	117
15·32	0·6	82·1	43·2	—	9·9	25·5	118
—	—	—	—	—	—	—	119
13·12	0·7	85·8	42·9	—	6·0	24·71	120
12·58	0·19	85·2	42·1	—	2·5	23·8	121
11·62	0·64	86·6	43·2	—		25·6	122
13·77	0·5	84·8	42·1	—	9·0	23·7	123
14·66	0·27	82·9	44·0	—	1·3	23·2	124
12·6	0·36	85·7	42·2	—	7·0	26·4	125
—	—	—	—	—	—	—	126
13·0	0·44	85·21	43·1	—	6·5	25·7	127
13·37	0·67	84·7	43·2	—	1·6	23·32	128
12·78	0·88	85·35	43·8	32·0	2·7	24·6	129
12·17	0·78	85·31	43·7	31·5	1·2	24·8	130
13·14	0·97	85·1	43·1	23·5	7·8	26·5	131
11·6	0·51	86·7	42·9	30·5	2·0	23·6	132
—	—	—	—	—	—	—	133
14·6	0·36	82·7	44·0	31·0	1·6	23·2	134
13·1	0·47	85·1	43·2	—	6·5	25·7	135
13·7	0·67	85·3	42·5	31.5	7·0	24·6	136
11·28	0·75	86·7	41·5	—	1·5	24·3	137
15·17	0·71	82·1	43·2	—	1·7	23·8	138
13·07	0·62	84·7	42·2	—	8·9	24·7	139
13·2	0·37	80·8	42·0	—	13·7	27·3	140
13·72	0·52	84·3	42·3	—	7·2	25·6	141
12·5	0·71	85·6	43·2	—	2·1	23·7	142
—	—	—	—	—	—	—	143
11·6	0·6	86·3	43·5	32·0	7·0	24·81	144
11·1	0·72	87·3	44·1	31·5	1·7	24·7	145
13·67	0·87	84·8	43·7	29·5	5·3	23·8	146
13·25	0·89	84·8	44·1	32·0	3·8	26.5	147*
12·7	1·2	84·3	43·2	32·5	5·7	25·9	148*
14·67	0·9	82·7	44·0	32·0	8·4	26·51	149*
11·92	0·95	86·3	43·5	32·5	7·3	26·0	150*
11·25	1·02	86·4	42·9	31·0	5·7	26·8	151*

* Siberian samples.

App. xxxii.

Table I. (A).

APPENDIX

A.—ANALYSES made in the Bacteriological

No.	Government and District.	Village or Farm.	"Farm" or "Collected" Milk.	Food.	Date of Butter-making.	Brand of Butter.	Was Cream Pasteurised?
					1901:		
152*	Tomsk, Kainsk	Alexindrin Agricultural Dairy.	Farm and collected.	—	—	—	—
153*	Tomsk, Kainsk	„ „	Collected	—	—	—	—
154*	Tomsk, Kainsk	„ „	„	—	—	—	—
155	Moguilev	Skrynshchina	Farm	—	1 February	—	—
156	Moguilev, Moguil	Golovchin	„	—	3 February	—	—
157	Moguilev, Chausk	Khdanovichi	„	—	5 February	—	—
158	Moguilev, Chausk	—	„	—	—	—	—
159*	Tobolsk, Snersk	Snersk Co-operative Dairy.	Collected	—	—	—	—
160*	Tobolsk, Snersk	„ „	„	—	15 January	—	—
161	Vologda, Griazov	Batanovo	Farm	Ordinary	3 February	Paris	Yes

* Siberian samples.

Table I. (B).

B.—ANALYSES MADE AT THE

No.	Government and District.	Village or Farm.	"Farm" or "Collected" Milk.	Food.	Date of Butter-making.	Brand of Butter.	Was Cream Pasteurised?	Weight of Sample at 100° C.
					1902:			
280	Moguilev, Orshan	Skrynshchina	Farm	—	15 February	Cream	—	0·8657
281	Moguilev, Orshan	„	„	—	22 February	„	—	0·8655
282	Moguilev, Orshan	„	„	—	1 March	„	—	0·8650
283	Moguilev, Orshan	„	„	—	8 March	„	—	0·8651
284	Moguilev, Orshan	„	„	—	15 March	Export	—	0·8659
285	Moguilev, Orshan	„	„	—	22 March	„	—	0·8658
286	Moguilev, Orshan	„	„	—	29 March	„	—	0·8653
287	Moguilev, Orshan	„	„	—	6 April	„	—	0·8651
288	Moguilev, Orshan	„	„	—	12 April	„	—	0·8659
289	Moguilev, Orshan	„	„	—	19 April	„	—	0·8660
290	Moguilev, Orshan	„	„	—	26 April	„	—	0·8651
291	Moguilev, Orshan	„	„	—	3 May	„	—	0·8652
292	Moguilev, Orshan and Seninsk.	Tolochin Dairy of Mr. Slavinsky.	„	—	14 February	Cream	—	0·8660
293	Moguilev, Orshan and Seninsk.	„	„	—	21 February	„	—	0·8658
294	Moguilev, Orshan and Seninsk.	„	„	—	28 February	„	—	0·8665
295	Moguilev, Orshan and Seninsk.	„	„	—	7 March	„	—	0·8655
296	Moguilev, Orshan and Seninsk.	„	„	—	14 March	„	—	0·8662

App. xxxii.
Table I. (A).

XXXII.—*continued.*

Laboratory of the Ministry of Agriculture—*continued.*

Water.	Ash.	Fat.	Refraction. Zeiss.	Melting Point.	Acidity.	Reichert-Wollny No	No.
Per Cent.	Per Cent.	Per Cent.		Degrees, C.			
13·7	0·92	85·7	43·2	32·0	8·3	25·7	152*
15·1	1·1	82·2	42·9	32·5	7·2	26·34	153*
13·4	1·01	84·7	43·2	32·5	3·3	26·0	154*
14·3	0·67	83·7	42·3	32·0	7·8	23·5	155
11·69	0·47	87·3	42·1	31·5	2·5	23·0	156
13·5	0·67	85·2	42·5	29·5	2·7	23·9	157
11·3	0·35	86·7	44·0	32·0	7·7	23·5	158
13·72	0·5	84·1	42·1	33·0		23·7	159*
13·0	0·45	85·2	42·6		6·5	25·7	160*
15·31	0·4	82·4	42·6	32·0	9·3	26·3	161

* Siberian samples.

Table I. (B).

ST. PETERSBURG CITY LABORATORY.

Water.	Ash.	Fat.	Refraction. Zeiss.	Melting Point.	Acidity.	Reichert-Wollny No.	Koettstorfer No.	Iodine No.	Hehner No.	No.
Per Cent.	Per Cent.	Per Cent.		Degrees, C.						
12·53	0·12	86·59	44·0	32·8—35·8	4·93	28·8	224·28	38·84	88·29	280
12·89	0·17	86·43	43·3	32·5—34·8	6·54	27·7	225·18	36·95	88·51	281
11·76	0·14	87·66	43·8	33·3—36·8	4·91	28·2	222·22	39·20	88·89	282
12·43	0·17	86·68	43·6	33·2—35·6	4·68	26·7	223·10	37·85	88·24	283
13·26	0·93	84·80	43·6	31·2—38·2	1·90	28·5	224·16	36·91	88·16	284
10·54	1·11	88·08	43·5	34·1—36·3	1·85	28·5	226·29	36·40	88·73	285
10·63	0·81	87·88	44·5	34·2—38·0	2·35	26·1	222·86	39·17	89·35	286
10·16	1·02	87·73	43·7	33·5—37·2	2·71	26·9	223·72	36·47	88·48	287
10·92	1·02	87·05	42·9	32·7—35·8	1·60	28·1	227·62	33·53	88·47	288
10·71	1·06	87·94	43·1	33·2—36·4	3·63	27·0	226·06	34·71	88·16	289
9·76	0·36	88·31	44·5	35·4—39·0	1·21	26·1	221·73	39·73	88·45	290
8·55	1·23	89·78	44·7	35·8—39·6	1·23	26·4	220·06	40·26	89·50	291
13·31	0·14	85·11	43·3	31·2—38·7	3·97	27·8	224·81	34·76	88·33	292
12·54	0·15	85·94	43·2	29·8—40·7	4·34	27·8	224·68	34·31	88·18	293
12·90	0·14	86·29	42·5	34·0—35·4	3·85	29·4	228·65	32·98	87·73	294
13·94	0·18	85·07	43·2	35·5—37·8	2·79	28·2	225·59	34·79	87·84	295
12·61	0·12	85·73	43·3	33·4—40·4	2·57	29·3	226·00	34·99	87·36	296

App. xxxii.
Tabl

APPENDIX

B.—ANALYSES at the

No.	Government and District.	Village or Farm.	"Farm" or "Collected" Milk.	Food.	Date of Butter-making.	Brand of Butter.	Was Cream Pasteurised?	Weight of Sample at 100° C.
					1902:			
297	Moguilev, Orshan and Seninsk.	Tolochin Dairy of Mr. Slavinsky.	Farm	—	21 March	Golstinsk	—	0·8662
298	Moguilev, Orshan and Seninsk.	„ „	—	—	28 March	„	—	0·8660
299	Moguilev, Orshan and Seninsk.	„ „	—	—	4 April	„	—	0·8655
300	Moguilev, Orshan and Seninsk.	„ „	Farm	—	2 April	„	—	0·8651
301	Moguilev, Orshan and Seninsk.	„ „	„	—	28 April	„	—	0·8657
302	Moguilev, Orshan and Seninsk.	„ „	„	—	25 April	„	—	0·8655
303	Moguilev, Orshan and and Seninsk.	„ „	„	—	2 May	„	—	0·8655
304	Moguilev, Moguilev	Golovshchina	„	—	10 February	Cream	—	0·8655
305	Moguilev, Moguilev	„	„	—	18 February	„	—	0·8652
306	Moguilev, Moguilev	„	„	—	24 February	—	—	0·8655
307	Moguilev, Moguilev	„	„	—	2 March	Cream	—	0·8657
308	Moguilev, Moguilev	„	„	—	12 March	„	—	0·8655
309	Moguilev, Moguilev	„	„	—	18 March	—	-	0·8660
310	Moguilev, Moguilev	„	„	—	27 March	Cream	—	0·8655
311	Moguilev, Moguilev	„	„	—	2 April	„	—	0·8655
312	Moguilev, Moguilev	„	„	—	8 April	„	—	0·8652
313	Moguilev, Moguilev	„	„	—	18 April	„	—	0·8652
314	Moguilev, Moguilev	„	„	—	26 April	„	—	0·8648
315	Moguilev, Moguilev	„	„	—	30 April	„	—	0·8645
316	Moguilev, Chausk	Zhdanovichi	„	—	2 February	Paris	—	0·8662
317	Moguilev, Chausk	„	„	—	18 February	„	—	0·8660
318	Moguilev, Chausk	„	„	—	25 February	„	—	0·8655
319	Moguilev, Chausk	„	„	—	4 March	„	—	0·8662
320	Moguilev, Chausk	„	„	—	10 March	Cream	—	0·8663
321	Moguilev, Chausk	„	„	—	18 March	Paris	—	0·8662
322	Moguilev, Chausk	„	„	—	25 March	„	—	0·8655
323	Moguilev, Chausk	„	„	—	1 April	Cream	—	0·8666
324	Moguilev, Chausk	„	„	—	8 April	Paris	—	0·8668
325	Moguilev, Chausk	„	„	—	22 April	„	—	0·8658
326	Moguilev, Chausk	„	„	—	30 April	„	—	0·8659
					1901:			
327*	Tomsk, Barnaulsk	Kashinsk Co-operative Dairy.	Collected	Plentiful, dry.	17 December	—	—	0·8650
328*	Tomsk, Barnaulsk	„ „	„	„	31 December	—	—	0·8658
					1902:			
329*	Tomsk, Barnaulsk	„ „	„	„	15 January	—	—	0·8657
330*	Tomsk, Kainsk	Taskaev Dairy	„	—	1 February	Export	—	0·8655

* Siberian butters.

App. xxxii.
Table I. (B).

XXXII—*continued.*

St. Petersburg City Laboratory—*continued.*

Water.	Ash.	Fat	Refraction. Zeiss.	Melting Point.	Acidity.	Reichert-Wollny No.	Koettstorfer No.	Iodine No.	Hehner No.	No.
Per Cent.	Per Cent.	Per Cent.		Degrees.						
9·60	1·10	88·76	43·2	33·7—35·7	1·22	29·8	225·94	35·30	88·22	297
15·08	0·61	83·17	44·0	34·2—36·5	0·97	29·2	226·12	37·95	88·17	298
11·27	0·83	87·12	44·2	35·8—38·4	1·01	26·8	224·59	36·94	88·74	299
9·51	0·85	88·81	44·5	36·0—38·6	0·97	26·6	221·49	38·18	88·73	300
10·87	0·99	86·59	44·0	37·6—37·7	1·09	26·9	223·21	37·12	88·81	301
8·82	1·34	89·33	44·4	34·5—37·9	0·60	27·7	223·97	38·81	88·92	302
10·01	1·67	88·05	44·8	33·2—38·4	0·91	25·2	219·20	40·17	89·41	303
15·65	0·04	83·71	43·7	32·1—35·5	5·86	26·7	222·75	36·62	88·65	304
16·28	0·07	83·04	43·6	29·6—39·2	2·62	26·3	221·57	35·45	89·11	305
15·26	0·07	84·16	43·5	31·8—38·0	3·55	26·0	221·35	36·45	88·42	306
14·70	0·05	83·92	43·8	32·3—40·0	3·89	26·2	221·27	35·85	89·16	307
14·67	0·07	84·78	43·8	30·8—39·3	3·66	25·7	223·69	36·21	89·58	308
14·98	0·09	84·77	43·3	34·4—36·2	4·77	27·7	225·74	34·96	88·36	309
15·72	0·07	83·80	43·8	34·7—37·6	5·91	26·7	222·69	36·64	89·28	310
15·34	0·08	84·10	44·0	33·8—37·1	4·13	25·2	222·60	36·97	89·24	311
15·53	0·07	83·42	43·4	34·0—36·8	5·22	25·9	224·10	34·34	89·15	312
13·16	0·09	85·98	44·8	33·8—36·6	6·00	24·4	219·21	24·09	89·94	313
13·50	0·09	86·01	46·0	33·8—36·8	2·38	22·9	216·55	45·44	90·29	314
13·74	0·09	85·84	46·6	33·4—37·6	4·40	20·4	213·98	47·89	90·37	315
13·29	0·08	85·72	44·2	30·6—36·7	3·77	27·9	223·59	38·68	88·82	316
12·51	0·09	87·34	44·2	33·8—36·2	2·21	28·8	224·26	38·05	87·95	317
12·99	0·18	86·38	44·3	29·4—39·6	1·68	28·3	223·01	30·56	88·72	318
13·36	0·19	86·09	44·5	34·2—36·2	1·54	27·4	224·34	39·78	87·56	319
13·06	0·05	86·36	44·3	32·8—40·1	2·45	28·7	225·77	38·93	88·13	320
12·26	0·98	86·06	44·4	34·1—40·8	0·97	28·2	223·52	39·72	88·38	321
12·56	0·12	87·25	43·6	33·8—36·0	1·56	28·4	228·35	36·12	88·01	322
12·46	0·10	87·15	43·5	33·2—36·8	2·02	29·3	227·36	35·83	88·09	323
12·97	0·11	86·29	43·2	33·2—35·8	1·27	30·1	229·36	35·62	87·89	324
11·66	0·14	87·17	44·1	33·8—36·8	2·45	27·6	225·94	38·53	88·46	325
13·54	0·12	86·33	45·2	33·4—36·8	1·55	26·9	222·16	43·34	88·55	326
9·89	1·36	86·33	43·3	34·8—37·6	1·44	27·1	224·20	34·15	88·46	327*
10·55	1·05	87·19	43·1	35·0—39·9	1·36	28·8	224·57	33·41	88·49	328*
10·66	1·88	86·46	43·2	33·4—39·8	1·62	26·9	224·63	34·10	88·59	329*
9·59	1·64	87·81	42·6	34·4—36·4	0·97	29·2	224·44	31·75	87·88	330*

* Siberian butters.

App. xxxii.
Table I. (B).

APPENDIX,

B.—ANALYSES at the

No.	Government and District.	Village or Farm.	"Farm" or "Collected" Milk.	Food.	Date of Butter-making.	Brand of Butter.	Was Cream Pasteurised?	Weight of Sample at 100° C.
					1902:			
331*	Tomsk, Kainsk	Varaxina	Collected	—	4 February	Export	—	0·8656
332*	Tomsk, Kainsk	„	„	—	11 April	„	—	0·8656
333*	Tomsk, Kainsk	„	„	—	18 February	„	—	0·8655
334*	Tomsk, Barnaul	Alexandrian Farm.	„	—	3 February	„	—	0·8660
335*	Tomsk, Barnaul	—	„	—	21 March	„	—	0·8652
336*	Tomsk, Barnaul	—	„	—	5 April	„	—	0·8652
337*	Tomsk, Barnaul	—	„	—	6 April	„	—	0·8648
338*	Tomsk, Barnaul	—	„	—	12 April	„	—	0·8651
339*	Tomsk, Barnaul	—	„	—	25 April	„	—	0·8650
340*	Tomsk, Kainsk	Kargat	„	—	4 April	„	—	0·8651
					1901:			
341*	Tomsk, Zmeinogorsk	Novo-Shipunovsk Co-operative Dairy.	„	Plentiful, dry.	19 December	—	—	0·8658
342*	Tomsk, Zmeinogorsk	„ „	„	„	31 December	—	—	0·8660
					1902:			
343*	Tomsk, Zmeinogorsk	„ „	„	„	15 January	—	—	0·8659
344*	Tobolsk, Montorovsk	Snersk Co-operative Dairy.	„	Ordinary	10 March	—	—	0·8659
345*	Tobolsk, Kourgans	Malo-Dubrovsk Co-operative Dairy.	„	„	26 March	—	—	0·8661
346*	Tobolsk, Kourgans	„	„	—	9 April	Export	Yes	0·8651
347*	Tobolsk, Kourgans	„	„	Ordinary	10 April	—	„	0·8655
348*	Tobolsk, Kourgans	„	„	„	29 April	Export	„	0·8651
349*	Tobolsk, Kourgans	Mishinsk Co-operative Dairy.	„	„	27 March	—	—	0·8657
350*	Tobolsk, Kourgans	„ „	„	„	10 April	—	—	0·8654
351*	Tobolsk, Kourgans	„ „	„	„	22 April	Export	No	0·8650
352*	Tobolsk, Tshimsk	Special Co-operative Dairy.	„	Scanty, dry.	12 April	—	—	0·8652
353*	Tobolsk, Tshimsk	„ „	„	„	23 April	Cream	No	0·8650
354	Yaroslav, Poshekh	Yashkanovo, Proprietor, T. A. Vinogradoff.	„	Plentiful, dry.	8 February	Export	„	0·8669

* Siberian butters.

X XII.—*continued.*

St. Petersburg City Laboratory—*continued.*

Water.	Ash.	Fat.	Refraction. Zeiss.	Melting Point.	Acidity.	Reichert-Wollny No.	Koettstorfer No.	Iodine No.	Hehner No.	o.
Per Cent.	Per Cent.	Per Cent.		Degrees, C.						
11·76	1·21	85·00	43·2	34·8—37·2	1·10	27·8	224·46	34·36	88·80	331
8·47	2·13	88·79	43·6	30·0—38·4	1·40	26·24	224·47	34·87	88·08	332*
11·61	1·66	85·42	44·0	32·1—40·5	1·39	26·0	223·08	36·83	88·84	333*
11·84	2·22	85·06	43·5	34·2—36·6	0·99	28·2	225·66	35·61	88·13	334*
12·34	1·37	84·95	44·7	35·5—38·3	1· 5	24·9	221·05	40·22	89·58	335*
10·60	2·11	86·20	44·8	34·3—37·8	1·04	24·7	221·27	39·80	89·91	336*
11·56	1·75	85·70	45·1	34·2—37·2	1·22	24·0	221·04	41·83	90·24	337*
10·07	1·61	87·16	45·2	35·6—38·8	0·94	24·4	220·16	41·30	89·73	338*
9·52	2·62	87·06	46·0	35·2—39·2	1·00	25·4	218·04	44·85	90·24	339*
9·56	1·39	88·40	45·2	33·8—37·3	1·04	24·7	221·31	42·13	90·13	340*
10·05	2·04	86·77	43·6	32·1—38·6	0·95	26·7	224·00	36·05	88·60	341*
10·58	1·43	86·84	43·8	34·2—36·5	0·89	26·3	223·04	36·03	84·00	342*
10·51	1·36	87·06	43·7	31·8—37·8	1·09	26·2	223·26	36·00	88·70	343*
10·41	1·72	86·97	42·6	34·4—36·2	1·24	29·4	226·16	31·62	88·34	344*
8·83	2·38	87·78	42·6	34·8—37·3	0·60	29·1	228·42	32·02	88·20	345*
8·70	2·39	88·07	44·6	34·5—37·2	0·78	25·5	220·44	39·65	89·76	346*
7·53	2·09	89·28	43·6	34·4—37·2	0·81	26·7	224·55	35·67	89·00	347*
9·78	2·02	87·63	44·9	34·8—38·4	0·40	25·0	219·93	40·58	89·05	348*
9·68	2·75	86·47	42·5	35·0—37·4	0·70	29·3	228·32	30·98	88·91	349*
8·55	3·29	86·29	43·1	34·6—38·2	0·81	27·0	225·70	33·13	88·76	350*
9·32	4·39	85·70	44·7	34·8—37·5	1·00	24·2	220·00	39·79	89·90	351*
12·01	2·08	84·54	44·1	34·4—37·0	1·02	26·1	222·40	37·08	89·20	352*
9·35	2·06	87·56	44·5	35·1—38·4	0·91	24·7	219·47	37·78	89·26	353*
7·56	1·50	89·85	43·0	32·8—38·4	1·30	30·3	227·55	33·40	87·87	354

* Siberian butters.

Director: S. LENIN.
Acting Principal of Department: A. BAKST.

App. xxxii.
Table I.
(Supplementary).

APPENDIX,
(Supplied by

*SUPPLEMENTARY TABLE I.

RESULTS OF ANALYSES OF SAMPLES OF BUTTER

(1) IN THE GOVERNMENT

No.	No. in Table I.	District.	Village or Farm.	"Farm" or "Collected" Milk.	Food.	Date of Butter-making.	Brand of Butter.	Was Cream Pasteurised?	Specific Gravity of Sample at 100° C.
						1901:			
1	1	Griazov	Jurievo	Farm	Plentiful, dry.	20 Oct.	Paris	Yes	—
2	3	Griazov	Alexino	Collected	Ordinary	23 Oct.	Export	No	—
	2	Griazov	Botalovo	Farm	„	24 Oct.	Paris	Yes	—
4	4	Griazov	Golovinsk	Collected	Scanty, marshy.	25 Oct.	„	„	—
5	14	Griazov	Silino	Farm	—	27 Oct.	„	„	—
6	25	Griazov	Golovinsk	Collected	Scanty, marshy.	2 Nov.	„	„	—
7	24	Griazov	Alexino	„	Ordinary	3 Nov.	„	„	—
8	23	Griazov	Botalovo	Farm	„	3 Nov.	„	„	—
9	28	Griazov	Silino	„	Scanty, marshy.	5 Nov.	„	„	—
10	34	Griazov	Botalovo	„	Ordinary	10 Nov.	„	„	—
11	37	Griazov	Alexino	Collected	„	10 Nov.	„	„	—
12	45	Griazov	Golovinsk	„	Scanty, marshy.	11 Nov.	„	„	—
13	44	Griazov	Silino	Farm	„	12 Nov.	„	„	—
14	52	Griazov	Golovinsk	Collected	„	20 Nov.	„	„	—
15	67	Griazov	„	„	Ordinary	29 Nov.	„	„	—
16	68	Griazov	Alexino	„	„	29 Nov.	„	„	—
17	72	Griazov	Silino	Farm	Scanty, marshy.	4 Dec.	„	„	—
18	73	Griazov	Botalovo	„	Ordinary	5 Dec.	„	„	—
19	76	Griazov	Golovinsk	Collected	Scanty, marshy.	7 Dec.	„	„	—
20	83	Griazov	„	„	„	20 Dec.	„	„	—
						1902:			
21	114	Griazov	Silino	Farm	„	2 Jan.	„	„	—
22	115	Griazov	Botalovo	„	Ordinary	3 Jan.	„	„	—
23	116	Griazov	Alexino	Collected	„	3 Jan.	Export	No	—
24	117	Griazov	Golovinsk	„	Scanty, marshy.	4 Jan.	Paris	Yes	—
25	129	Griazov	Botalovo	Farm	Ordinary	15 Jan.	—	—	—
26	130	Griazov	Alexino	Collected	„	17 Jan.	—	—	—
27	146	Griazov	„	„	„	1 Feb.	Export	No	—
28	161	Griazov	Botalovo	Farm	„	3 Feb.	Paris	Yes	—
29	—	Griazov	Alexino	Collected	—	11 May	Export	—	0·8656
30	—	Griazov	Golovinsk	—	—	13 May	Paris	—	0·8658
31	—	Griazov	„	—	—	9 June	Export	—	0·8655
32	—	Griazov	Alexino	—	—	10 June	„	—	0·8664
33	—	Griazov	„	—	—	14 July	Paris	—	—
34		Griazov	Silino	—	—	16 July	„	—	—

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* This Supplementary Table shows the samples grouped as regards their

App. xxxii.

Table I. (*Supplementary*).

XXXII.

the Russian Government.)

* SUPPLEMENTARY TABLE I.

COLLECTED BY GOVERNMENT DAIRY INSTRUCTORS.

OF VOLOGDA.

Water.	Ash.	Fat.	Refraction. Zeiss.	Melting Point.	Acidity.	Reichert-Wollny No.	Koettstorfer No.	Iodine No.	Hehner No.	No. in Table I.	No.
Per Cent.	Per Cent.	Per Cent.		Degrees, C.							
12·329	0·64	86·721	43·1	32·0	1·4	—	—	—	—	1	1
10·625	1·02	86·89	43·6	33·0	2·1	—	—	—	—	3	2
10·0	0·80	87·5	43·6	33·0	3·8	—	—	—	—	2	3
12·17	1·0	85·98	43·2	32·0	10·5	—	—	—	—	4	4
11·75	0·61	87·12	43·5	33·5	2·3	—	—	—	—	14	5
12·14	0·73	85·89	44·8	33·0	12·8	—	—		—	25	6
10·65	0·65	87·95	44·1	34·0	10·8	—	—	—		24	7
11·707	0·76	86·63	43·0	33·5	17·5	—	—	—	—	23	8
11·25	0·95	86·32	43·9	32·0	2·7	—	—	—	—	28	9
9·36	0·28	88·97	44·0	32·0	4·0	22·67	—	—	—	34	10
12·57	0·97	85·7	43·6	33·5	4·3	25·41	—		—	37	11
11·5	0·79	86·9	42·9	32·0	5·7	26·53	—		—	45	12
13·68	0·88	84·72	43·7	32·0	1·0	26·12	—		—	44	13
13·35	0·37	85·75	44·1	—	1·7	23·84	—		—	52	14
11·91	0·93	85·12	43·4	—	2·9	26·18	—		—	67	15
9·53	0·7	87·7	43·6	—	33·0	26·74	—			68	16
12·87	0·87	85·31	44·7	32·0	2·9	25·3	—		—	72	17
11·88	0·63	85·97	44·6	32·5	6·1	24·64	—	—	—	73	18
12·10	0·84	85·21	43·6	—	2·7	25·3	—	—	—	76	19
12·67	1·01	84·93	43·5	—	16·7	—		—	—	83	20
13·08	0·51	86·51	43·1	—	2·0	21·89		—	—	114	21
13·35	0·73	84·52	43·6	—	1·7	26·3	—	—	—	115	22
16·2	0·29	81·7	44·2	—	7·3	24·6		—	—	116	23
11·28	0·35	86·3	44·0	—	1·5	24·7	—	—		117	24
12·78	0·88	85·35	43·8	32·0	2·7	24·6		—		129	25
12·17	0·78	85·31	43·7	31·5	1·2	24·8	—	—	—	130	26
13·67	0·87	84·8	43·7	29·5	5·3	23·8	—	—	—	146	27
15·31	0·4	82·4	42·6	32·0	9·3	26·3	—	—	—	161	28
8·46	1·79	88·85	43·3	35·0—36·8	1·14	27·7	224·50	36·39	89·11	—	29
11·30	0·106	88·02	45·1	34·8—37·7	5·00	26·3	222·00	43·96	89·30		30
8·16	1·49	89·80	45·0	35·8—39·0	1·52	28·2	221·80	41·69	89·63	—	31
8·30	1·57	89·34	44·5	34·0—36·8	1·03	29·9	225·71	40·38	88·63	—	32
—	0·14	—	45·5	34·8—39·6	14·37	24·2	218·32	44·25	—	—	33
—	0·15	—	45·6	35·4—39·4	7·00	24·8	219·02	43·45	—	—	34

origin. It includes the figures in Table I., but contains many others also.

App. xxxii.
Table I.
(*Supplementary*).

APPENDIX,

RESULTS of Analyses of Samples of Butter

(2) IN THE GOVERNMENT

No.	No. in Table I.	District.	Village or Farm.	"Farm" or "Collected" Milk.	Food.	Date of Butter-making.	Brand of Butter.	Was Cream Pasteurised?	Specific Gravity of Sample at 100° C.
						1901:			
35	1a	Poshekhon	Yashkanovo	Collected	Plentiful, dry.	19 Oct.	Export	No	—
36	17	Romanov	Lytarovo	Farm	Ordinary	26-28-30 Oct.	,,	,,	—
37	16	Poshekhon	Yashkanovo	Collected	Plentiful	1 Nov.	,,	,,	—
38	15	Romanov	Tomarovo	Farm	—	1 Nov.	Paris	Yes	—
39	26	Romanov	Horpaevo	Collected	Plentiful, dry.	4 Nov.	,,	,,	—
40	27	Romanov	Alexeievsk	Farm	,,	15–18 Aug.	Export	No	—
41	29	Lubimovsk	Martianovo	Collected	Scanty, marshy.	6 Nov.	Paris	Yes	—
42	30	Poshekhon	Yashkanovo	,,	Plentiful, dry.	6 Nov.	Export	No	—
43	31	Lubimovsk	Buzhepinovo	,,	Ordinary	8 Nov.	Paris	Yes	—
44	42	Romanov	Lytarovo	Farm	,,	12 Nov.	,,	,,	—
45	43	Romanov	Tomarovo	,,	Scanty, marshy.	12 Nov.	,,	,,	—
46	46	Lubimovsk	Buzheninovo	Collected	Ordinary	15 Nov.	,,	,,	—
47	48	Romanov	Horpaevo	,,	Plentiful, dry.	16 Nov.	,,	,,	—
48	49	Romanov	Alexeievsk	Farm	,,	17 Nov.	,,	,,	—
49	54	Romanov	Tomarovo	,,	Scanty, marshy.	19 Nov.	,,	,,	—
50	55	Poshekhon	Yashkanovo	Collected	Plentiful, dry.	20 Nov.	Export	No	—
51	57	Romanov	Alexeievsk	Farm	,,	22 Nov.	Paris	Yes	—
52	64	Lubimovsk	Buzheninovo	Collected	Ordinary	25 Nov.	,,	,,	—
53	65	Lubimovsk	Martianovo	,,	Scanty, marshy.	25 Nov.	,,	,,	—
54	70	Poshekhon	Yashkanovo	,,	Plentiful, dry.	1 Dec.	Export	,,	—
55	71	Poshekhon	,,	,,	,,	3 Dec.	,,	No	—
56	79	Lubimov	Buzheninovo	,,	Ordinary	3 Dec.	Paris	Yes	—
57	75	Romanov	Lytarovo	Farm	,,	6 Dec.	Export	No	—
58	77	Romanov	Tomarovo	,,	Scanty, marshy.	7 Dec.	Paris	Yes	—
59	81	Poshekhon	Yashkanovo	Collected	Plentiful, dry.	18 Dec.	Export	No	—
						1902:			
60	113	Poshekhon	Yashkanovo	Collected	Plentiful, dry.	2 Jan.	,,	No	—
61	124	Romanov	Tomarovo	Farm	Scanty, marshy.	3 Jan.	Paris	Yes	—
62	123	Romanov	Horpaevo	Collected	Plentiful, dry.	5 Jan.	,,	,,	—
63	120	Romanov	Komutoff	Farm	Ordinary	5 Jan.	Export	No	—
64	121	Romanov	Alexeievsk	,,	Plentiful, dry.	6 Jan.	,,	,,	—
65	125	—	—	—	—	—	—	—	—
66	122	Lubimov	Buzheninovo	Collected	Ordinary	8 Jan.	Paris	Yes	—
67	135	Romanov	Lytarovo	Farm	,,	19 Jan.	Export	No	—
68	142	Romanov	Tomarovo	,,	Scanty, marshy.	19 Jan.	Paris	Yes	—
69	137	Romanov	Alexeievsk	,,	Plentiful, dry.	20 Jan.	Export	No	—
70	136	Lubimov	Martianovo	Collected	Scanty, marshy.	21 Jan.	Paris	Yes	—
71	138	Lubimov	Buzheninovo	,,	Ordinary	23 Jan.	,,	,,	—
72	354	Poshekhon	Yashkanovo	—	—	8 Feb.	Export	No	0·8669
73	—	Poshekhon	,,	—	—	9 May	,,	—	0·8659
74	—	Romanov	Alexeievsk	—	—	5 June	,,	—	0·8658

XXXII—*continued.*

App. xxxii. Table I. (*Supplementary*).

Collected by Government Dairy Instructors—*continued.*

OF YAROSLAV.

Water.	Ash.	Fat.	Refraction. Zeiss.	Melting Point.	Acidity.	Reichert-Wollny No.	Koettstorfer No.	Iodine No.	Hebner No.	No. in Table I.	No.
Per Cent.	Per Cent.	Per Cent.		Degrees, C.							
11·43	1·3	86·55	42·7	32·0	2·7	—	—	—	—	1*a*	35
11·92	0·92	87·22	44·0	32·0	10·9	—	—	—	—	17	36
13·19	0·79	85·3	43·5	33·0	9·2	—	—	—	—	16	37
10·83	0·59	88·32	43·7	33·0	6·7	—			—	15	38
12·155	0·65	85·97	42·9	32·5	6·7	—		—	—	26	39
12·0	1·49	85·21	43·1	32·0	8·8	—		—	—	27	40
11·18	0·77	86·77	42·4	32·5	3·2	—		—	—	29	41
13·72	1·14	83·73	43·0	34·0	2·0	—		—	—	30	42
11·35	0·68	87·33	44·5	34·0	10·9	23·04		—	—	31	43
11·59	0·53	86·3	43·8	31·5	8·1	24·67		—	—	42	44
15·7	0·71	82·11	43·6	31·5	1·2	26·0	—	—	—	43	45
11·19	0·78	86·42	43·2	33·5	3·4	24·71		—	—	46	46
8·69	0·54	88·97	43·6	—	4·7	21·78	—	—	—	48	47
15·57	1·27	82·1	44·0	—	2·1	26·07		—	—	49	48
13·23	0·89	84·72	44·8	—	4·9	23·98		—	—	54	49
12·70	1·3	84·21	43·8	—	3·8	26·84			—	55	50
15·18	0·67	82·7	43·9	—	8·4	22·0		—		57	51
13·92	1·03	83·251	44·2	—	2·1	26·31			—	64	52
13·34	0·79	84·71	43·8	—	1·6	26·74		—	—	65	53
11·93	1·35	85·72	44·2	33·0	3·9	23·98		—		70	54
16·0	0·98	80·4	45·1	—	2·7	22·0		—	—	71	55
13·5	0·98	84·2	44·0	32·0	1·2	26·98		—	—	79	56
13·62	1·72	83·92	43·2	33·0	2·2	24·10	—	—	—	75	57
11·27	0·79	86·54	43·7	28·5	3·1	25·57		—	—	77	58
13·07	1·3	84·1	43·2	—	7·2	—		—	—	81	59
11·35	0·7	86·7	42·0	—	1·5	23·08	—		—	113	60
14·66	0·27	82·9	44·0	—	1·3	23·2	—	—	—	124	61
13·77	0·5	84·8	42·1	—	9·0	23·7		—	—	123	62
13·12	0·7	85·8	42·0	—	3·0	24·71	—		—	120	63
12·58	0·19	85·2	42·1	—	2·5	23·8	—	—		121	64
12·6	0·36	85·7	42·2		7·0	26·4	—		—	125	65
11·62	0·64	86·6	43·2	—	8·7	25·6	—			122	66
13·1	0·47	85·1	43·2	—	6·5	25·7	—		—	135	67
12·5	0·71	85·6	43·2	—	2·1	23·7	—		—	142	68
11·28	0·75	86·7	41·5	—	1·5	24·3	—	—	—	147	69
13·7	0·67	85·3	42·5	31·5	7·0	24·6	—	—	—	136	70
15·17	0·71	82·1	43·2	—	1·7	23·8	—	—	—	138	71
7·56	1·50	89·85	43·0	32·8—38·4	1·30	30·3	227·55	33·40	87·87	354	72
7·18	1·33	90·81	43·7	33·8—35·9	1·07	28·6	224·47	36·23	88·75	—	73
8·59	1·67	88·98	45·7	37·2—38·4	2·10	26·8	221·50	44·46	89·18	—	74

App. xxxii.
Table I.
(Supplementary).

RESULTS of Analyzes of Samples of Butter

(2) IN THE GOVERNMENT

No.	No in Table I.	District.	Village or Farm.	"Farm" or "Collected" Milk.	Food.	Date of Butter Making.	Brand of Butter.	Was Cream Pasteurised?	Specific Gravity of Samples at 100° C.
						1902.			
75		Poshekhon	Yashkanovo	–	—	8 June	Export	–	0·8661
76		Lubimov	Buzheninovo		—	10 June	Paris	–	0·8655
77	–	Lubimov	Martianovo		—	June	Export	–	0·8660
78	–	Romanov	Alexeieusk	–	—	5 July	,,	–	–
79	–	Lubimov	Buzheninovo		—	7 July	,,	—	–
80		Lubimov	Martianovo		—	7 July	,,	—	
81	—	Poshekhon	Yashkanovo	–	—	14 July	,,	—	
82		Romanov	Alexeieusk		—	6 Aug.	,,	–	–
83	—	Lubimov	Martianovo	–	—	7 Aug.	,,	—	—
84	–	Lubimov	Buzheninovo	–	—	8 Aug.	,,	–	—

(2) IN THE GOVERNMENT

No.	No in Table I.	District.	Village or Farm.	"Farm" or "Collected" Milk.	Food.	Date of Butter Making.	Brand of Butter.	Was Cream Pasteurised?	Specific Gravity of Samples at 100° C.
						1901.			
85	13	Sienninsk	Estate Bielitga	Farm	—	Beginning	Export	No	—
86	12	Rogachevsk	,, Ostermansk	,,	—	Middle June	,,	,,	–
87	22	Chausk	,, Thdanovichi	,,	—	Middle June	,,	,,	—
88	10	Rogachevsk	,, Diedlovo	,,	—	Middle June	,,	,,	—
89	9	Gomelsk	,, Dourovichi	,,	—	End June	,,	,,	—
90	11	Mogilevsk	,, Krugloe	,,	—	Middle July	,,	,,	
91	7	Mogilevsk	,, ,,	,,	—	28 Sept.	Cream	,,	—
92	5A	Orshansk	,, Zariechie	,,	—	5 Oct.	,,	,,	—
93	5	Sienninsk	,, Bielitza	,,	—	18 Oct.	,,	,,	—
94	8	Rogachevsk	,, Ostermansk	,,	—	20 Oct.	,,	,,	—
95	6	Rogachevsk	,, Diedlovo	,,	—	23 Oct.	,,	,,	—
96	18	Orshansk	,, Zariechie	,,	Ordinary	25 Oct.	,,	,,	
97	21	Sienninsk	,, Bielitza	,,	—	25 Oct.	,,	,,	—
98	19	Gomelsk	,, Dourovichi	,,	–	26 Oct.	,,	,,	–
99	20	Moguilevsk	,, Krugloe	,,	—	27 Oct.	,,	,,	
100	35	Orshansk	,, Zariechie	,,	—	30 Oct.	,,	,,	–
101	36	Moguilevsk	,, Golovshchina	,,	—	1 Nov.	,,	,,	—
102	32	Rogachevsk	,, Diedlovo	,,	—	2 Nov.	,,	,,	—
103	33	Rogachevsk	,, Ostermansk	,,	—	3 Nov.	,,	,,	–
104	38	Gomelsk	,, Dourovichi	,,	—	3 Nov.	,,	,,	—
105	39	Rogachevsk	,, Diedlovo	,,	–	5 Nov.	,,	,,	—
106	40	Rogachevsk	,, Ostermansk	,,	—	7 Nov.	,,	,,	—
107	41	Sienninsk	,, Bielitza	,,	—	11 Nov.	,,	,,	—
108	48A	Moguilevsk	,, Golovshchina	,,	–	14 Nov.	—	—	
109	48B	Gomelsk	,, Dourovichi	,,		15 Nov.	—	–	
110	58	Orshansk	,, Zariechie	,,		18 Nov.	Cream	No	
111	59	Gomelsk	,, Dourovichi	,,	—	18 Nov.	,,	,,	
112	60	Sieninsk	,, Bielitza	,,		20 Nov.	,,	,,	

App. xxxii.
Table I.
(Supplementary).

XXXII—*continued.*

Collected by Government Dairy Instructors—*continued.*

OF YAROSLAV—*continued.*

Water.	Ash.	Fat.	Refraction. Zeiss.	Melting Point.	Acidity.	Reichert-Wollny No.	Koettstorfer No.	Iodine No.	Hehner No.	No. in Table I.	No.
Per Cent.	Per Cent.	Per Cent.		Degrees, C.							
·11	1·70	89·87	45·1	34·7 37·8	1·55	28·3	222·53	72·37	88·80	—	75
12·62	0·11	86·70	44·1	33·5 -37·6	14·10	28·2	223·96	41·90	88·41	-	76
9·41	1·25	88·80	45·1	34·8 -38·6	2·16	29·2	222·77	42·74	89·18	—	77
—	3·22	—	45·1	34·5 -38·6	5·09	27·0	222·74	42·46	-	—	78
—	2·42	—	45·1	34·0 -38·8	5·36	27·3	221·49	42·39		—	79
	2·23	—	44·8	34·2 -38·2	1·86	27·9	223·22	40·77	·	—	80
	1·52		45·8	35·8 -39·8	1·40	24·7	218·23	43·57		-	81
		—		-	3·80	24·5	217·20	47·36		—	82
·	—			—	2·61	27·2	219·78	43·83	..	-	83
-				-	1·92	27·5	219·64	44·31		—	84

OF MOGUILEV.

Water.	Ash.	Fat.	Refraction. Zeiss.	Melting Point.	Acidity.	Reichert-Wollny No.	Koettstorfer No.	Iodine No.	Hehner No.	No. in Table I.	No.
12·3	0·82	85·77	45·1	34·0	4·2	—	—		-	13	85
13·19	1·66	84·72	42·9	31·0	3·6	-	-			12	86
11·722	1·19	86·57	42·8	33·0	5·2	—	—			22	87
13·92	1·17	84·19	43·2	32·5	2·7		-	-		10	88
13·9	0·78	85·17	43·7	33·0	3·3		-	-		9	89
12·99	1·69	86·1	43·6	32·0	1·7	-	—	—		11	90
11·11	0·82	87·01	42·6	34·0	8·8		—	—		7	91
11·46	0·92	86·44	44·2	33·0	4·6		—	—		56	92
12·2	0·67	86·71	43·2	32·0	2·2		—			5	93
13·17	0·19	85·11	42·9	32·0	2·4	—	—		—	8	94
12·10	0·69	86·38	43·7	31·0	9·8	—	—	-	—	6	95
10·69	0·79	88·51	44·5	32·0	6·8	—	—	—	—	18	96
13·5	0·6	85·93	43·8	34·0	6·8	—	—	—	—	21	97
13·07	0·81	86·35	43·2	33·0	11·3	-	—	—	—	19	98
11·55	0·67	87·25	43·6	33·0	5·0	—	—	—	—	20	99
10·7	0·57	87·59	43·6	33·0	1·2	23·5	—	—	-	35	100
11·3	0·6	86·51	42·8	33·5	9·5	26·0	..	—	—	36	101
11·37	0·71	87·21	43·6	33·0	11·3	24·81	—	—	—	32	102
13·0	0·76	85·31	48·8	33·0	8·1	22·98		-	—	33	103
11·47	0·66	86·39	42·9	34·0	1·4	22·11			—	31	104
11·53	0·73	86·88	43·0	32·5	3·8	23·13			—	39	105
10·19	0·84	87·3	43·9	32·0	2·5	23·12				40	106
11·89	0·27	86·7	43·2	29·0	5·3	23·89			-	41	107
13·87	0·62	85·1	44·0	—	2·1	36·07			-	48a	108
13·21	0·75	85·3	43·2	—	7.0	25·3			—	48b	109
10·88	0·67	86·93	44·0	-	1·9				-	58	110
12·98	0·99	84·57	43·1	31·5	4·8	—	—		-	59	111
14·67	0·85	82·89	44·0	-	1·3	23·7			-	60	112

App. xxxii.
Table I.
(Supplementary).

APPENDIX,

RESULTS of Analyses of Samples of Butter

(3) IN THE GOVERNMENT

No.	No. in Table I.	District.	Village or Farm.	"Farm" or "Collected" Milk.	Food.	Date of Butter-making.	Brand of Butter.	Was Cream Pasteurised?	Specific Gravity of Sample at 100° C.
						1901:			
113	61	Moguilevsk	Estate Golovshchina	Farm	—	20 Nov.	Cream	No	—
114	62	Rogachevsk	„ Diedlovo	„	—	23 Nov.	„	„	—
115	63	Rogachevsk	„ Ostermansk	„	—	23 Nov.	Paris	Yes	—
116	98	Moguilevsk	„ Golovshchina	„	—	11 Dec.	—	—	—
117	99	Moguilevsk	„ Skrinshchina	„	—	14 Dec.	—	—	—
118	102	Chaussk	„ Zhdanovichi	„	—	18 Dec.	—	—	—
119	103	Moguilevsk	„ Golovshchina	„	—	18 Dec.	—	—	—
120	104	Moguilevsk	„ Skrinshchina	„	—	21 Dec.	—	—	—
121	105	Moguilevsk	„ Tolochino	„	—	21 Dec	—	—	—
122	106	Chaussk	„ Zhdanovichi	„	—	—	—	—	—
123	107	—	„ Skrinshchina	„	—		—	—	—
124	108	—	„ Tolochino	„	—	28 Dec.	—	—	—
125	110	Moguilevsk	„ Golovshchina	„	—	—	—	—	—
126	111	Moguilevsk	„ „	„	—	—	—	—	—
						1902:			
127	112	Chaussk	„ Zhdanovichi	Farm	—	1 Jan.	—	—	—
128	118	Moguilevsk	„ Skrinshchina	„	—	4 Jan.	Paris	Yes	—
129	127	Moguilevsk	„ „	„	—	11 Jan.	—	—	—
130	131	Chaussk	„ Zhdanovichi	„	—	14 Jan.	—	—	—
131	128	Moguilevsk	„ Golovshchina	„	—	15 Jan.		—	—
132	132	Chaussk	„ Skrinshchina	„	—	18 Jan.	—	—	—
133	134	Chaussk	„ Zhdanovichi	Farm	—	21 Jan.	—	—	—
134	139	Moguilevsk	„ Golovshchina	„	—	22 Jan.	—	—	—
135	140	—	„ Tolochino	„	—	25 Jan.	—	—	—
136	141	—	„ Skrinshchina	„	—	25 Jan.	—	—	—
137	144	Moguilevsk	„ Golovshchina	„	—	27 Jan.		—	—
138	145	Chaussk	„ Zhdanovichi	„	—	29 Jan.		—	—
139	155	—	„ Skrinshchina	„	—	1 Feb.		—	—
140	156	Moguilevsk	„ Golovshchina	„		3 Feb.	—	—	—
141	157	Chaussk	„ Zhdanovichi	„	—	5 Feb.	—	—	—
142	158	—	—	„	—	—		—	—
143	280	Orshansk	„ Skrinshchina	—	—	15 Feb.	Cream	—	0·8657
144	281	Orshansk	„ „	—	—	22 Feb.	„	—	0·8655
145	282	Orshansk	„ „	—	—	1 Mar.	„	—	0·8650
146	283	Orshansk	„ „	—	—	8 Mar.	„	—	0·8651
147	284	Orshansk	„ „	—	—	15 Mar.	Golstinsk	—	0·8659
148	285	Orshansk	„ „	—	—	22 Mar.	Export	—	0·8658
149	286	Orshansk	„ „	—	—	29 Mar.	„	—	0·8653
150	287	Orshansk	„	—	—	6 April	„	—	0·8651
151	288	Orshansk	„	—	—	12 April	„	—	0·8659

App. xxxii.

Table I. (*Supplementary*).

XXXII—*continued.*

Collected by Government Dairy Instructors—*continued.*

MOGUILEV—*continued.*

Water.	Ash.	Fat.	Refraction. Zeiss.	Melting Point.	Acidity.	Reichert-Wollny No.	Koettstorfer No.	Iodine No.	Hehner No.	No. in Table I.	No.
Per Cent.	Per Cent.	Per Cent.		Degrees, C.							
12·59	0·59	85·2	43·2	—	7·4	26·51	—	—	—	61	113
13·04	0·65	85·39	43·5	—	4·2	26·41	—	—	—	62	114
13·76	0·81	84·53	43·6	32·5	1·8	23·32	—	—	—	63	115
13·6	0·5	85·3	42·1	32·0	1·4	23·5	—	—	—	98	116
15·57	0·37	82·31	44·5	32·5	2·7	21·85	—	—	—	99	117
13·24	0·67	84·60	44·8	32·0	5·9	23·99	—	—	—	102	118
12·16	0·6	85·87	43·1	31·0	7·0	23·84	—	—	—	103	119
10·69	0·53	88·2	42·1	—	2·2	23·0	—	—	—	104	120
12·30	0·42	85·7	43·1	—	2·9	24·66	—	—	—	105	121
11·7	0·39	86·8	42·5	—	8·3	23·9	—	—	—	106	122
15·6	0·89	82·3	43·1	—	1·2	23·18	—	—	—	107	123
12·9	0·66	84·51	42·5	—	4·8	23·8	—	—	—	108	124
11·5	0·71	86·7	43·0	—	8·2	24·6	—	—	—	110	125
13·15	0·67	85·4	42·5	—	2·2	24·8	—	—	—	111	126
11·9	0·62	86·31	43·0	—	7·5	23·98	—	—	—	112	127
15·32	0·6	82·1	43·2	—	9·9	25·5	—	—	—	118	128
13·0	0·44	85·21	43·1	—	6·5	25·7	—	—	—	127	129
13·14	0·97	85·1	43·1	32·5	7·8	26·5	—	—	—	131	130
13·27	0·67	84·7	43·2	—	1·6	23·32	—	—	—	128	131
11·6	0·51	86·7	42·9	30·5	2·0	23·6	—	—	—	132	132
14·6	0·36	82·7	44·0	31·0	1·6	23·2	—	—	—	134	133
13·07	0·62	84·7	42·2	—	8·9	24·7	—	—	—	139	134
17·2	0·37	80·8	42·0	—	13·7	27·3	—	—	—	140	135
13·72	0·52	84·3	42·3	—	7·2	25·6	—	—	—	141	136
11·6	0·6	86·3	43·5	32·0	7·0	24·81	—	—	—	144	137
11·1	0·72	87·3	44·1	31·5	1·7	24·7	—	—	—	145	138
14·3	0·67	83·7	42·3	32·0	7·8	23·5	—	—	—	155	139
11·69	0·47	87·3	42·1	31·5	2·5	23·0	—	—	—	156	140
13·5	0·67	85·2	42·5	29·5	2·7	23·9	—	—	—	157	141
11·3	0·35	86·7	44·0	32·0	7·7	23·5	—	—	—	158	142
12·53	0·12	86·59	44·0	32·8—35·8	4·93	28·8	224·28	38·84	88·29	280	143
12·89	0·17	86·43	43·3	32·5—34·8	6·54	27·7	225·18	36·95	88·51	281	144
11·76	0·14	87·66	43·8	33·3—36·8	4·91	28·2	222·22	39·20	88·89	282	145
12·43	0·17	86·68	43·6	33·2—35·6	4·88	26·7	223·10	37·85	88·24	283	146
13·26	0·93	84·80	43·6	31·2—38·2	1·90	28·5	224·16	36·91	88·16	284	147
10·54	1·11	88·08	43·5	34·1—36·3	1·85	28·5	226·29	36·40	88·73	285	148
10·63	0·81	87·88	44·5	34·2—38·0	2·35	26·1	222·86	39·17	89·35	286	149
10·16	1·02	87·73	43·7	33·5—37·2	2·71	26·9	223·72	36·47	88·48	287	150
10·92	1·02	87·05	42·9	32·7—35·8	1·60	28·1	227·62	33·53	88·47	288	151

App. xxxii.

Table I.
(*Supplementary*).

APPENDIX,

RESULTS of Analyses of Samples of Butter

(3) IN THE GOVERNMENT

No.	No. in Table I.	District	Village or Farm.	"Farm" or "Collected" Milk.	Food.	Date of Butter-making.	Brand of Butter.	Was Cream Pasteurised?	Specific Gravity of Sample at 100° C.
						1902:			
152	289	Orshansk	Estate Skrinsh-china.	—	—	19 April	Export	—	0·8660
153	290	Orshansk	„ „	—	—	26 April	„	—	0·8651
154	291	Orshansk	„ „	—	—	3 May	„	—	0·8652
155	—	Orshansk	„ „	—	—	10 May	„	—	0·8650
156	—	Orshansk	„ „	—	—	17 May	„	—	0·8655
157	—	Orshansk	„ „	—	—	24 May	„	—	0·8658
158	—	Orshansk	„ „	—	—	31 May	„	—	0·8664
159	—	Orshansk	„ „	—	—	7 June	„	—	0·8662
160	—	Orshansk	„ „	—	—	14 June	„	—	0·8662
161	—	Orshansk	„ „	—	—	21 June	„	—	0·8662
162	—	Orshansk	„ „	—	—	28 June	„	—	0·8660
163	—	Orshansk	„ „	—	—	5 July	„	—	0·8662
164	—	Orshansk	„ „	—	—	12 July	„	—	—
165	—	Orshansk	„ „	—	—	19 July	„	—	
166	—	Orshansk	„ „	—	—	26 July	„	—	
167	—	Orshansk	„ „	—	—	2 Aug.	„	—	
168	—	Orshansk	„ „	—	—	9 Aug.	„	—	
169	292	Orshansk and Sieninsk.	Tolochinsk Creamery.	—	—	14 Feb.	Cream	—	0·8660
170	293	Orshansk and Sieninsk.	„ „	—	—	21 Feb.	„	—	0·8658
171	294	Orshansk and Sieninsk.	„ „	—	—	28 Feb.	„	—	0·8665
172	295	Orshansk and Sieninsk.	„ „	—	—	7 Mar.	„	—	0·8655
173	296	Orshansk and Sieninsk.	„ „	—	—	14 Mar.	„	—	0·8662
174	297	Orshansk and Sieninsk.	„ „	—	—	21 Mar.	Export	—	0·8662
175	298	Orshansk and Sieninsk.	„ „	—	-	28 Mar.	„	—	0·8660
176	299	Orshansk and Sieninsk.	„ „	—		4 April	„	—	0·8655
177	300	Orshansk and Sieninsk.	„ „		-	11 April	„	—	0·8651
178	301	Orshansk and Sieninsk.	„ „	-		18 April	„	-	0·8657
179	302	Orshansk and Sieninsk.	„ „	—		25 April	„	-	0·8655
180	303	Orshansk and Sieninsk.	„ „	—	-	2 May	„	—	0·8675
181	—	Orshansk and Sieninsk.	„ „	—	—	9 May	„	—	0·8648
182	—	Orshansk and Sieninsk.	„ „	—	—	16 May	„	-	0·8658
183	—	Orshansk and Sieninsk.	„ „	—	—	23 May	„	—	0·8657
184	—	Orshansk and Sieninsk.	„ „	-	-	31 May	Cream	—	0·8656
185	—	Orshansk and Sieninsk.	„ „	—	—	7 June	„	-	0·8658
186	—	Orshansk and Sieninsk.	„ „	—	—	13 June	Export	—	0·8675
187	—	Orshansk and Sieninsk.	„ „	—	—	20 June	„	—	0·8652
188	—	Orshansk and Sieninsk.	„ „	—		27 June	„	—	0·8659
189	—	Orshansk and Sieninsk.	„ „	—		4 July	„	—	0·8647
190	—	Orshansk and Sieninsk.	„ „	—	—	18 July	„	—	0·8650
191	—	Orshansk and Sieninsk.	„ „	—	-	18 July	„		—
192	—	Orshansk and Sieninsk.	„ „	—	—	26 July	„	—	—

XXXII.—*continued.*

App. xxxii.

Table I. (*Supplementary*).

Collected by Government Dairy Instructors—*continued.*

OF MOGUILEV—*continued.*

Water.	Ash.	Fat.	Refraction. Zeiss.	Melting Point.	Acidity.	Reichert-Wollny No.	Koettstorfer No.	Iodine No.	Hehner No.	No. in Table I.	No.
Per Cent.	Per Cent.	Per Cent.		Degrees, C.							
10·71	1·06	87·94	43·1	33·2—36·4	3·63	27·0	226·06	34·71	88·16	289	152
9·76	0·36	88·31	44·5	35·4—38·0	1·21	26·1	221·73	39·73	88·45	290	153
8·55	1·23	89·78	44·7	35·8—39·6	1·23	26·4	220·06	40·26	89·50	291	154
8·95	1·27	88·99	43·7	32·1—38·9	1·27	24·2	217·52	44·18	89·82	—	155
8·88	1·18	89·32	45·6	37·2—40·4	1·35	25·4	218·89	45·04	89·82	—	156
8·75	1·88	88·67	44·95	36·4—38·5	0·83	27·9	220·95	43·71	89·06	—	157
10·33	1·75	87·25	44·75	36·0—38·1	0·94	30·4	225·68	40·87	87·71	—	158
9·02	2·33	87·30	44·7	36·0—39·6	0·85	29·2	223·28	40·71	88·79	—	159
9·61	2·72	87·10	44·8	35·6—38·5	0·91	27·6	224·32	41·14	88·93		160
10·04	1·61	87·45	44·5	35·0—38·6	1·07	29·1	224·40	39·63	88·43		161
9·25	2·86	86·65	44·5	35·4—38·8	1·02	28·4	223·69	40·70	88·62		162
8·92	1·97	87·95	44·9	32·8—37·6	0·93	28·5	226·17	41·02		—	163
—	2·37		45·2	35·4—40·2	1·22	27·3	221·81	41·74	—	—	164
—	2·34		44·8	35·6—40·2	0·90	26·8	221·06	40·12	—	—	165
—	2·02		45·2	35·8—39·4	1·00	27·4	221·21	40·84	—	—	166
—	1·16		45·4	36·0—40·4	1·85	25·8	219·47	41·77	—		167
—	1·88		45·5	35·2—39·4	1·09	24·9	219·67	42·54		—	168
13·31	0·14	85·11	43·3	31·2—38·7	3·97	27·8	224·81	34·76	88·33	292	169
12·54	0·15	85·94	43·2	29·8—40·7	4·34	27·8	224·68	34·31	88·18	293	170
12·90	0·14	86·29	42·5	34·0—35·4	3·85	29·4	228·65	32·98	87·73	294	171
13·94	0·18	85·07	43·2	35·5—37·8	2·79	28·2	225·59	34·79	87·84	295	172
12·61	0·12	85·73	43·3	33·4—40·4	2·57	29·3	226·00	34·99	87·36	296	173
9·60	1·10	88·76	43·2	33·7—35·7	1·22	29·8	225·94	35·30	88·22	297	174
15·08	0·61	83·17	44·0	34·2—36·5	0·97	29·2	226·12	37·95	88·17	298	175
11·27	0·83	87·12	44·2	35·8—38·4	1·01	26·8	224·59	36·94	88·75	299	176
9·51	0·85	88·81	44·5	36·0—38·6	0·97	26·6	221·49	38·18	88·73	300	177
10·87	0·99	86·59	44·0	34·6—37·7	1·09	26·9	223·21	37·12	88·81	301	178
8·82	1·34	89·33	44·4	34·5—37·9	0·80	27·7	223·97	38·81	88·92	302	179
10·01	1·67	88·05	44·8	33·2—38·4	0·91	25·2	219·90	40·17	89·41	303	180
10·86	1·78	86·50	44·7	36·4—39·3	0·83	25·0	218·15	42·64	88·72		181
14·48	0·94	84·60	44·8	35·4—37·8	1·95	28·0	222·22	42·87	89·34	—	182
15·75	1·04	83·09	44·65	34·3—36·8	2·19	26·3	219·58	43·23	89·56	—	183
17·89	0·16	80·46	44·35	33·9—36·9	5·80	28·1	223·39	40·06	87·73	—	184
12·90	0·07	84·07	44·9	35·1—37·4	1·02	28·7	222·24	40·88	88·79	—	185
14·24	1·64	83·02	45·2	35·6—38·2	1·52	26·5	220·45	41·47	89·64	—	186
11·06	1·48	85·98	44·8	36·6—40·2	1·44	26·3	220·32	40·27	89·24	—	187
10·34	1·07	86·96	45·0	35·7—39·8	1·86	24·4	218·88	40·63	89·70		188
10·86	1·76	86·15	45·5	36·2—40·6	2·11	23·9	219·32	41·71		—	189
9·47	1·91	87·77	45·5	34·2—39·2	1·36	24·9	219·22	43·15	—		190
	1·88	—	45·5	36·8—40·6	1·56	24·2	217·87	41·59	—	—	191
—	2·80	—	45·4	35·8—38·6	1·62	24·6	218·64	41·70		—	192

RESULTS of Analyses of Samples of Butter

(3) IN THE GOVERNMENT

No.	No. in Table I.	District.	Village or Farm.	"Farm" or "Collected" Milk.	Food	Date of Butter-making.	Brand of Butter.	Was Cream Pasteurised?	Specific Gravity of Sample at 100° C.
						1902:			
193	—	Sienninsk	Estate Tolochine	—	—	2 Aug.	Export	—	—
194	—	Sienninsk	,, ,,	—	—	9 Aug.	,,	—	
195	304	Moguilevsk	Estate Golovshchina.	—	—	10 Feb.	Cream	—	0·8655
196	305	Moguilevsk	,, ,,		—	18 Feb.	,,	—	0·8652
197	306	Moguilevsk	,, ,,	—	—	24 Feb.	,,	—	0·8655
198	307	Moguilevsk	,, ,,	—	—	2 Mar.	,,	—	0·8657
199	308	Moguilevsk	,, ,,	—	—	12 Mar.	,,	—	0·8655
200	309	Moguilevsk	,, ,,	—	—	18 Mar.	,,	—	0·8660
201	310	Moguilevsk	,, ,,	—	—	27 Mar.	,,	—	0·8655
202	311	Moguilevsk	,, ,,	—	—	2 April	,,	—	0·8655
203	312	Moguilevsk	,, ,,	—	—	8 April	,,	—	0·8652
204	313	Moguilevsk	,, ,,	—	—	18 April	,,	—	0·8652
205	314	Moguilevsk	,, ,,	—	—	26 April	,,	—	0·8648
206	315	Moguilevsk	,, ,,	—	—	30 April	,,	—	0·8645
207	—	Moguilevsk	,, ,,	—	—	7 May	,,	—	0·8650
208	—	Moguilevsk	,, ,,	—	—	13 May	Export	—	0·8652
209	—	Moguilevsk	,, ,,	—	—	22 May	,,	—	0·8657
210	—	Moguilevsk	,, ,,		—	27 May	,,	—	0·8659
211	—	Moguilevsk	,, ,,	—	—	10 June	,,	—	0·8654
212	—	Moguilevsk	,, ,,	—	—	25 June	,,	—	0·8660
213	—	Moguilevsk	,, ,,	—	—	13 July	,,	—	—
214	—	Moguilevsk	,, ,,	—	—	25 July	,,	—	—
215	316	Chaussk	Estate Zadanovich.	—	—	11 Feb.	Paris	—	0·8662
216	317	Chaussk	,, ,,	—	—	18 Feb.	,,	—	0·8660
217	318	Chaussk	,, ,,	—	—	25 Feb.	,,	—	0·8655
218	319	Chaussk	,, ,,	—	—	4 Mar.	,,	—	0·8662
219	320	Chaussk	,, ,,	—	—	10 Mar.	Cream	—	0·8663
220	321	Chaussk	,, ,,	—	—	18 Mar.	Paris	—	0·8662
221	322	Chaussk	,, ,,	—	—	25 Mar.	,,	—	0·8665
222	323	Chaussk	,, ,,		—	1 April	Cream	—	0·8666
223	324	Chaussk	,, ,,	—		8 April	Paris	—	0·8668
224	325	Chaussk	,, ,,	—	—	22 April	,,	—	0·8658
225	326	Chaussk	,, ,,	—	—	30 April	,,	—	0·8659
226	—	Chaussk	,, ,,		—	6 May	,,	—	0·8662
227		Chaussk	,, ,,		—	14 May	,,	—	0·8660
228	—	Chaussk	,, ,,		—	19 May	,,	—	0·8658
229	—	Chaussk	,, ,,		—	26 May	,,	—	0·8659
230	—	Chaussk	,, ,,		—	3 June	,,	—	0·8655
231	—	Chaussk	,, ,,	—	—	14 June	,,	—	0·8655
232	—	Chaussk	,, ,,	—	—	17 June	,,	—	0·8653
233	—	Chaussk	,, ,,		—	26 June	,,	—	0·8649

App. xxxii.

Table I.
(Supplementary).

XXXII.—*continued.*

Collected by Government Dairy Instructors—*continued.*

OF MOGUILEV—*continued.*

Water.	Ash.	Fat.	Refraction. Zeiss.	Melting Point.	Acidity.	Reichert-Wollny No.	Koettstorfer No.	Iodine No.	Hehner No.	No. in Table I.	No.
Per Cent.	Per Cent.	Per Cent.		Degrees, C.							
—	1·35	—	45·5	34·8—39·6	3·32	24·7	217·67	42·04	—	—	193
—	1·36	—	45·4	35·2—39·4	3·38	23·7	218·60	41·76	—	—	194
15·65	0·04	83·71	43·7	32·1—35·5	5·86	26·7	222·75	36·62	88·65	304	195
16·28	0·07	83·04	43·6	29·6 39·2	2·62	26·3	221·57	35·45	89·11	305	196
15·26	0·07	84·16	43·5	31·8—38·0	3·55	26·0	221·35	36·45	88·42	306	197
14·70	0·05	83·92	43·8	32·3—40·0	3·89	26·2	221·97	35·85	89·16	307	198
14·67	0·07	84·78	43·8	30·8—39·3	3·66	25·7	223·60	36·21	89·58	308	199
14·98	0·09	84·77	43·3	34·4—36·2	4·77	27·7	225·74	34·96	88·36	309	200
15·72	0·07	83·80	43·8	34·7—37·6	5·91	26·7	222·69	36·64	89·28	310	201
15·34	0·08	84·10	44·0	33·8—37·1	4·13	25·2	222·60	36·97	89·24	311	202
15·53	0·07	83·42	43·4	34·0—36·8	5·22	25·9	224·10	34·34	89·15	312	203
13·16	0·09	85·98	44·8	33·8—36·6	6·00	24·4	219·91	41·09	89·97	313	204
13·50	0·09	86·01	46·0	33·8—36·8	2·38	22·9	216·55	45·44	90·29	314	205
13·74	0·09	85·84	46·6	33·4—37·6	4·40	20·4	213·98	47·89	90·37	315	206
13·20	0·48	86·64	45·7	36·3—38·9	2·22	21·2	214·54	47·58	90·01	—	207
12·55	0·70	86·41	46·1	36·8 40·2	1·72	23·2	216·63	47·31	90·26	—	208
13·89	0·54	85·22	43·45	36·6 38·9	2·44	25·4	220·05	44·95	89·46	—	209
11·07	1·12	87·32	45·65	36·5—38·6	1·07	27·1	220·46	44·63	88·13	—	210
11·20	0·72	87·81	45·8	35·8—39·6	1·94	26·3	218·90	45·30	89·63		211
11·42	0·53	87·59	45·2	33·8 37·0	3·76	27·5	223·11	43·18	89·57	—	212
—	1·96	—	46·1	36·8—41·2	3·80	23·8	215·58	45·58	—	—	213
—	2·31	—	46·2	35·8—39·0	1·91	25·6	219·39	45·23		—	214
13·29	0·08	85·72	44·2	30·6—36·7	3·77	27·9	223·59	38·68	88·82	316	215
12·51	0·09	87·34	44·2	33·8—36·2	2·21	28·8	224·26	38·05	87·95	317	216
12·99	0·18	86·38	44·3	29·4—39·6	1·68	28·3	223·01	39·56	88·72	318	217
13·36	0·19	86·09	44·5	34·2 36·2	1·54	27·4	224·35	39·78	87·56	319	218
13·06	0·05	86·36	44·3	32·8—40·1	2·45	28·7	225·77	38·93	88·13	320	219
12·26	0·98	86·06	44·4	34·1—40·8	0·97	28·2	223·52	39·72	88·38	321	220
12·56	0·12	87·25	43·6	33·8—36·0	1·56	28·4	228·35	36·12	88·01	322	221
12·46	0·10	87·15	43·5	33·2—36·8	2·02	29·3	227·36	35·83	88·09	323	222
12·97	0·11	86·29	43·2	33·2—35·8	1·27	30·1	229·36	35·62	87·09	324	223
11·66	0·14	87·17	44·1	33·8—36·8	2·45	27·6	225·94	38·53	88·46	325	224
13·51	0·12	86·33	45·2	33·4—36·8	1·55	26·9	222·16	43·34	88·55	326	225
13·57	0·072	86·27	45·9	31·8—35·9	1·83	26·9	221·70	46·58	88·17	—	226
12·34	0·0906	87·07	45·2	32·4—37·6	3·09	28·1	220·98	46·93	88·18	—	227
14·14	0·063	85·50	45·35	31·9—38·2	3·94	28·6	222·25	45·10	88·41	—	228
12·67	0·080	86·85	44·75	37·4—39·9	0·85	28·8	222·73	44·07	88·90	—	229
13·42	0·03	86·12	45·0	37·6—41·2	2·43	27·9	221·07	40·80	89·14		230
17·00	0·11	82·14	45·4	35·2—38·8	7·06	26·7	219·99	48·47	89·47	—	231
13·25	0·07	86·09	44·6	38·6—41·8	2·78	29·1	221·20	39·34	89·06	—	232
13·22	0·09	86·01	44·5	37·5—42·6	5·82	27·1	219·02	39·46	89·31	—	233

App. xxxii.
Table I.
(Supplementary).

APPENDIX,

RESULTS of Analyses of Samples of Butter

(3) IN THE GOVERNMENT

No.	No. in Table I.	District.	Village or Farm.	"Farm" or "Collected" Milk.	Food.	Date of Butter-making.	Brand of Butter.	Was Cream Pasteurised?	Specific Gravity of Sample at 100° C.
234	—	Chausk	Estate Zhdanovichi.	—	—	1902: 2 July	Paris	—	0·8650
235	—	Chausk	,, ,,	—	—	10 July	,,	—	0·8645
236	—	Chausk	,, ,,	—	—	25 July	,,	—	—
237	—	Chausk	,, ,,	—	—	6 Aug.	,,	—	—
238	—	Chausk	,, ,,	—	—	15 Aug.	,,	—	—

(4) IN THE GOVERNMENT

No.	No. in Table I.	District.	Village or Farm.	"Farm" or "Collected" Milk.	Food.	Date of Butter-making.	Brand of Butter.	Was Cream Pasteurised?	Specific Gravity of Sample at 100° C.
239	85	Yalutorsk	Sonersk Association Factory.	Collected	—	—	—	—	—
240	86	Yalutorsk	,, ,,	,,	—	—	—	—	—
241	87	Yalutorsk	,, ,,	,,	—	—	—	—	—
242	88	Yalutorsk	,, ,,	,,	—	—	—	—	—
243	89	Yalutorsk	,, ,,	,,	—	—	—	—	—
244	90	Yalutorsk	,, ,,	,,	—	—	—	—	—
245	159	Yalutorsk	,, ,,	,,	—	—	—	—	—
246	160	Yalutorsk	,, ,,	,,	—	15 Jan.	—	—	—
247	344	Yalutorsk	,, ,,	,,	—	10 Mar.	—	—	0·8659
248	—	Yalutorsk	,, ,,	,,	—	3 May	Export	—	0·8652
249	—	Yalutorsk	,, ,,	,,	—	10 May	,,	—	0·8655
250	—	Yalutorsk	,, ,,	,,	—	18 May	,,	—	0·8663
251	—	Yalutorsk	,, ,,	,,	—	25 May	,,	—	0·8662
252	—	Yalutorsk	,, ,,	,,	—	1 June	,,	—	0·8658
253	—	Yalutorsk	,, ,,	,,	—	8 June	,,	—	0·8653
254	—	Yalutorsk	,, ,,	,,	—	22 June	,,	—	0·8661
255	—	Yalutorsk	,, ,,	,,	—	13 July	,,	—	—
256	—	Yalutorsk	,, ,,	,,	—	2 Aug.	,,	—	—
257	91	Kourgan	Mitinsk Association Factory.	,,	—	15 Nov.	—	—	—
258	92	Kourgan	,, ,,	,,	—	24 Nov.	—	—	—
259	93	Kourgan	,, ,,	,,	—	27 Nov.	—	—	—
260	94	Kourgan	,, ,,	,,	—	30 Nov.	—	—	—
261	95	Kourgan	,, ,,	,,	—	10 Dec.	—	—	—
262	96	Kourgan	,, ,,	,,	—	12 Dec.	—	—	
263	97	Kourgan	,, ,,	,,	—	14 Dec.	—	—	
264	349	Kourgan	,, ,,	,,	—	27 Mar.	—	—	0·8657
265	350	Kourgan	,, ,,	,,	—	10 April	—	—	0·8654
266	351	Kourgan	,, ,,	,,	—	22 April	Export	No.	0·8650
267	—	Kourgan	,, ,,	,,	—	1 May	,,	—	0·8653
268	—	Kourgan	,, ,,	,,	—	4 May	,,	—	0·8654
269	—	Kourgan	,, ,,	,,	—	10 May	,,	—	0·8661
270	—	Kourgan	,, ,,	,,	—	17 May	,,	—	0·8666
271	—	Kourgan		,,	—	24 May	,,	—	0·8662
272	—	Kourgan	,, ,,	,,	—	31 May	,,	—	0·8658

XXXII *continued.*

Collected by Government Dairy Instructors—*continued.*

OF MOGUILEV—*continued.*

Water.	Ash.	Fat.	Refraction. Zeiss.	Melting Point.	Acidity.	Reichert-Wollny No.	Koettstorfer No.	Iodine No.	Hehner No.	No. in Table I.	No.
Per Cent.	Per Cent.	Per Cent.		Degrees, C.							
11·51	0·10	87·79	44·5	40·6—44·8	2·90	28·2	222·19	38·06	89·41	—	234
12·07	0·08	87·45	44·6	41·6—45·0	2·47	27·6	220·52	37·73	—	—	235
—	0·08	—	45·4	36·7—40·4	5·60	25·9	219·24	42·79	—	—	236
—	0·12	—	45·6	36·6—40·5	4·01	26·4	219·91	43·45	—	—	237
—	—	—	—	—	2·50	26·1	218·66	43·62	—	—	238

OF TOBOLSK.

Water.	Ash.	Fat.	Refraction. Zeiss.	Melting Point.	Acidity.	Reichert-Wollny No.	Koettstorfer No.	Iodine No.	Hehner No.	No. in Table I.	No.
11·59	1·7	86·11	43·5	—	8·3	24·86	—	—	—	85	239
15·54	1·21	82·13	43·0	—	6·6	25·57	—	—	—	86	240
12·48	0·93	85·31	42·9	—	3·0	26·65	—	—	—	87	241
13·11	0·99	85·71	43·1		7·1	25·7			—	88	242
13·45	1·02	84·6	43·1	—	8·0	24·71		—	—	89	243
13·71	0·7	84·8	43·2	—	2·7	25·6			—	90	244
13·72	0·5	84·1	42·1	33·0	9·9	23·7	—	—	—	159	245
13·0	0·45	85·2	42·6	33·0	6·5	25·7		—		160	246
10·41	1·72	86·97	42·5	34·4—36·2	1·24	29·4	226·16	31·62	88·34	344	247
9·58	1·41	88·00	44·2	35·7—39·1	1·71	25·1	219·71	41·50	89·30	—	248
10·44	1·13	87·46	44·65	36·0—39·0	1·60	25·5	219·62	41·64	89·74	—	249
11·46	1·68	86·02	43·65	32·6—35·2	0·95	28·0	226·17	38·89	88·63	—	250
10·41	2·72	85·99	44·1	30·6—36·2	0·72	29·0	226·43	38·00	88·39	—	251
10·64	1·49	86·95	44·2	35·0—38·2	1·49	27·9	223·48	38·46	88·93	—	252
11·12	1·36	86·71	44·5	35·8—39·2	1·77	26·7	222·83	38·89	88·90	—	253
10·34	1·62	87·23	43·6	36·6—40·2	2·39	28·3	227·57	36·38	—	—	254
—	1·31	—	44·0	34·8—39·2	3·21	27·5	222·18	37·09	—	—	255
—	1·38	—	44·5	34·2—38·5	5·14	25·6	221·19	38·11	—	—	256
15·16	1·1	82·3	43·9	—	7·2	25·0		—		91	257
11·11	0·9	87·8	44·0	31·0	4·8	24·7	—	—	—	92	258
12·57	1·3	85·3	43·8	32·0	7·0	26·51		—	—	93	259
11·5	1·21	86·8	43·1	32·0	2·0	23·89	—		—	94	260
10·7	1·2	87·7	43·6	33·0	1·5	25·7		—		95	261
13·2	0·7	85·4	42·8	32·0	7·3	24·8			—	96	262
14·3	0·75	83·9	42·3	33·0	2·1	25·41				97	263
9·63	2·75	86·47	42·5	35·0—37·4	0·70	29·3	228·32	30·98	88·04	349	264
8·55	3·29	86·29	43·1	34·6—38·2	0·81	27·0	225·70	33·13	88·76	350	265
9·73	4·39	85·70	44·7	34·8—37·5	1·00	24·2	220·00	39·79	89·90	351	266
9·80	5·08	84·24	44·6	34·1—37·6	0·58	26·2	221·06	41·68	88·72	—	267
10·10	4·72	84·47	44·1	33·5—37·1	0·40	26·5	220·99	41·74	88·86	—	268
10·83	2·46	85·98	44·3	33·9—36·8	0·96	28·5	224·71	40·09	88·81	—	269
10·95	2·12	86·22	43·65	32·6—35·3	0·73	28·2	5·79	38·15	88·65	—	270
11·05	1·64	86·09	44·0	33·8—36·4	1·03	26·7	225·23	37·45	88·68	—	271
11·02	2·57	85·05	43·6	31·4—37·6	0·07	28·7	224·34	35·91	88·58	—	272

App. xxxii.

Table I. (*Supplementary*).

APPENDIX,

RESULTS of Analyses of Samples of Butter

(4) IN THE GOVERNMENT

No	No. in Table I.	District.	Village or Farm.	"Farm" or "Collected" Milk.	Food.	Date of Butter-making.	Brand of Butter.	Was Cream Pasteurised?	Specific Gravity of Sample at 100° C.
						1902:			
273	—	Kourgan	Mitinsk Association Dairy.	Collected	—	7 June	Export		0·8660
274	—	Kourgan	,, ,,	,,		14 June	,,		0·8661
275	—	Kourgan	,, ,,	,,	—	21 June	,,		0·8662
276		Kourgan	,, ,,	,,		28 June	,,		0·8652
277	—	Kourgan	,, ,,	,,	—	5 July	,,		0·8651
278	—	Kourgan	,, ,,	,,	—	12 July	,,		—
279	—	Kourgan	,, ,,	,,	—	18 July	,,		—
280	—	Kourgan	,, ,,	,,	—	26 July	,,		—
281	—	Kourgan	,, ,,	,,		31 July	,,		—
282	345	Kourgan	,, ,,	,,	—	26 Mar.	,,		0·8661
283	346	Kourgan	,, ,,	,,	—	9 April	,,	Yes	0·8651
284	347	Kourgan	,, ,,	,,	—	10 April	Collected	,,	0·8655
285	348	Kourgan	,, ,,	,,	—	29 April	Export	,,	0·8651
286	—	Kourgan	,, ,,	,,	—	6 May	,,		0·8665
287	—	Kourgan	,, ,,	,,	—	17 May	,,		0·8663
288	—	Kourgan	,, ,,	,,	—	23 May	,,	—	0·8661
289	—	Kourgan	,, ,,	,,		31 May	,,	—	0·8658
290	—	Kourgan	,, ,,	,,		7 June	,,		0·8655
291	—	Kourgan	,, ,,	,,		14 June	,,	—	0·8658
292	—	Kourgan	,, ,,	,,		20 July	,,	—	—
293	—	Kourgan	,, ,,	,,		27 July	,,	—	—
294	352	Tshimsk	Special Association Dairy.	—	—	12 April	—	—	0·8652
295	353	Tshimsk	,, ,,	—	—	23 April	Cream	No	0·8650
296	—	Tshimsk	,, ,,	—	—	2 May	Export	—	0·8667
297	—	Tshimsk	,, ,,	—	—	13 May	,,		0·8662
298	—	Tshimsk	,, ,,	—	—	28 May	,,		0·8663
299	—	Tshimsk	,, ,,	—	—	7 June	,,	—	0·8660
300	—	Tshimsk	,, ,,	—	—	26 June	,,	—	0·8656
301	—	Tshimsk	,, ,,	—	—	6 July	,,	—	—
302	—	Tshimsk	,, ,,		—	19 July	,,	—	—
303	—	Tshimsk	,, ,,	—		31 July	,,		—
304	—	Jukalinsk	Koulikovo		—	17 May	,,		0·8660
305	—	Jukalinsk	,,	—	—	23 May	,,		0·8656
306	—	Jukalinsk	,,		—	4 June	,,		0·8660
307	—	Jukalinsk	,,			9 June	,,		0·8662
308	—	Jukalinsk	,,	—		16 June	,,		0·8657
309	—	Jukalinsk	,,			25 June	,,		0·8665
310	—	Jukalinsk	,,			16 July	,,		—
311		Jukalinsk	,,			23 July	,,		
312		Jukalinsk	,,			30 July	,,		
313		Jukalinsk	,,			6 Aug.	,,		—

App. xxxii.

Table I.
(*Supplementary*).

XXXII—*continued.*

Collected by Government Dairy Instructors—*continued.*

OF TOBOLSK—*continued.*

Water.	Ash.	Fat.	Refraction. Zeiss.	Melting Point.	Acidity.	Reichert-Wollny No.	Koettstorfer No.	Iodine No.	Hehner No.	No. in Table I.	No.
Per Cent.	Per Cent.	Per Cent.		Degrees, C.							
9·65	3·0	86·91	44·1	34·7—38·6	0·81	27·7	224·47	37·71	88·37	—	273
10·58	4·70	83·57	43·8	33·8—36·2	0·86	28·1	225·71	37·04	88·44	—	274
10·62	3·06	84·94	43·3	34·0—36·8	0·89	28·7	226·76	35·09	88·56	—	275
10·08	2·75	85·03	44·4	35·2—39·8	1·03	26·1	224·48	37·05	—	—	276
10·08	2·58	86·32	44·0	35·0—39·2	0·90	26·4	225·29	36·08	—	—	277
—	2·78	—	44·0	35·7—37·8	1·20	27·6	223·34	36·31	—	—	278
—	2·40	—	44·2	35·6—39·2	1·14	27·5	223·23	37·08	—	—	279
—	2·56	—	44·4	35·6—38·0	1·32	26·5	222·91	37·56	—	—	280
—	2·00	—	44·2	34·6—37·0	1·25	27·2	223·76	37·49	—	—	281
8·83	2·38	87·78	42·6	34·8—37·8	0·80	29·1	228·42	32·02	88·20	345	282
8·70	2·39	88·07	44·6	34·5—37·2	0·78	25·5	220·44	39·65	89·76	346	283
7·53	2·09	89·28	43·6	34·4—37·2	0·81	26·7	224·55	35·67	89·00	347	284
9·78	2·02	87·63	44·9	34·8—38·4	0·40	25·0	219·93	40·68	89·05	348	285
9·39	2·05	87·60	44·1	32·1—34·9	0·75	28·9	226·13	38·92	88·24	—	286
11·36	2·10	85·82	43·35	32·3—35·1	0·44	29·0	226·42	36·83	88·54	—	287
9·63	2·83	86·25	43·4	32·6—35·2	0·73	28·7	227·45	35·[illegible]2	88·17	—	288
10·11	1·53	87·50	43·9	34·8—38·0	0·66	27·9	222·32	36·39	88·86	—	289
10·05	2·05	85·92	44·0	35·6—38·2	0·76	28·5	223·92	37·07	88·41	—	290
10·47	3·03	85·73	43·8	35·2—38·2	0·83	28·1	224·49	36·28	88·82	—	291
—	2·08	—	44·4	36·5—40·5	0·60	28·4	221·76	37·23	—	—	292
—	1·70	—	43·9	35·5—39·0	1·21	29·1	224·01	35·13	—	—	293
12·01	2·08	84·54	44·1	34·4—37·0	1·02	26·1	222·40	37·08	89·20	352	294
9·35	2·06	87·56	44·5	35·1—38·4	0·91	24·7	219·47	37·78	89·26	353	295
9·73	1·76	87·54	43·3	31·3—34·8	0·98	29·0	227·32	37·17	88·33		296
10·55	1·79	86·59	43·55	33·7—36·2	0·70	29·3	225·81	35·86	88·31	—	297
10·68	1·84	86·40	43·1	33·0—35·4	0·97	30·1	227·99	33·98	87·79	—	298
10·10	1·57	87·21	43·2	34·2—37·5	1·65	28·4	227·05	35·53	88·15	—	299
10·18	2·11	86·68	43·8	36·4—40·8	1·15	28·3	225·82	35·62	88·91	—	300
—	2·42	—	43·6	36·2—39·8	1·22	29·5	224·62	34·47	—	—	301
—	1·84	—	44·0	36·2—39·8	1·28	28·0	223·84	35·97	—	—	302
—	2·18	—	43·6	35·4—29·0	1·27	27·9	225·27	35·12		—	303
10·23	0·92	87·60	43·95	32·5—35·3	2·12	27·9	224·02	37·87	88·49	—	304
8·49	1·69	89·10	43·35	32·2—34·9	1·12	28·7	228·13	35·91	88·00		305
11·83	2·51	84·10	43·6	33·1—36·8	1·86	29·0	225·38	36·52	88·46	—	306
10·70	2·83	85·77	43·6	33·5—37·8	1·15	28·0	225·85	35·88	88·39	—	307
10·86	1·85	85·81	42·9	36·2—39·5	2·30	29·4	228·16	32·85	88·13	—	308
10·51	2·08	84·86	43·3	34·0—38·4	2·16	29·8	227·83	34·75	88·18	—	309
—	3·47	—	43·2	35·7—38·4	2·28	29·9	226·75	33·13	—	—	310
—	2·88	—	43·0	35·2—38·4	1·81	29·6	227·61	32·16	—	—	311
—	2·51	—	43·0	35·0—37·8	1·48	30·1	227·63	32·81	—	—	312
—	—	—	—	—	1·29	30·7	227·17	33·98			313

App. xxxii.

Table I. (*Supplementary*).

APPENDIX,

RESULTS of Analyses of Samples of Butter

(5) IN THE GOVERNMENT

No.	No. in Table I.	District.	Village or Farm.	"Farm" or "Collected" Milk.	Food.	Date of Butter-making.	Brand of Butter.	Was Cream Pasteurised?	Specific Gravity of Sample at 100° C.
						1902:			
314	147	Kaïnsk	Alexandrovsk	Collected	Ordinary	1 Feb.			
315	148	Kaïnsk	,,	,,	,,				—
316	149	Kaïnsk	,,	,,	,,				—
317	150	Kaïnsk	,,	,,	,,	—			
318	151	Kaïnsk	,,	,,	,,	—			—
319	152	Kaïnsk	,,	,,	,,		—		—
320	334	Kaïnsk	,,	,,		3 Feb.			0·8660
321	335	Kaïnsk	,,	,,		21 Mar.			0·8652
322	336	Kaïnsk	,,	,,		5 April			0·8652
323	337	Kaïnsk	,,	,,		6 April			0·8648
324	338	Kaïnsk	,,	,,	—	12 April	—		0·8651
325	339	Kaïnsk	,,	,,		25 April	—	—	0·8650
326	—	Kaïnsk	,,	,,		6 May	Export	—	0·8657
327	—	Kaïnsk	,,	,,		27 May	,,		0·8665
328	—	Kaïnsk	,,	,,		—	,,		0·8663
329	—	Kaïnsk	,,	,,		20 June	,,		0·8659
330	—	Kaïnsk	,,	,,		2 July	,,		0·8654
331	—	Kaïnsk	,,	,,		20 July	,,		0·8655
332	153	Kaïnsk	,,	,,					—
333	154	Kaïnsk	,,	,,		—	—		—
334	330	Kaïnsk	Toxaev	,,		1 Feb.	Export	—	0·8655
335	331	Kaïnsk	Vil. Varaxina	—		4 Feb.	,,	—	0·8656
336	332	Kaïnsk	,, ,,	—		11 April	,,	—	0·8656
337	333	Kaïnsk	,, ,,	—	—	18 April	,,		0·8655
338	340	Kaïnsk	V. Kargat	—		4 April	,,	—	0·8651
339	—	Kaïnsk	V. Toxaevsk	—	—	9 May	,,	—	0·8650
340	—	Kaïnsk	V. Varaxina	—	—	18 May	,,	—	0·8650
341	—	Kaïnsk	V. Kargaz	—	—	15 May	,,	—	0·8655
342	—	Kaïnsk	,, ,,	—		18 June	,,		0·8656
343	—	Kaïnsk	,, ,,			20 June	,,		0·8602
						1901:			
344	327	Barnaülsk	Kashinsk Assoc. Dairy.			17 Dec.	,,	—	0·8650
345	328	Barnaülsk	,, ,,			31 Dec.	,,		0·8658
						1902:			
346	329	Barnaülsk	,, ,,			15 Jan.	,,		0·8657
347	—	Barnaülsk	,, ,,		—	1 Feb.	,,		0·8660
348	—	Barnaülsk	,, ,,			14 Jan.	,,		—
349	—	Barnaülsk	,, ,,			20 Jan.	,,		
350	—	Barnaülsk	,,			19 Feb.	,,		0·8655
351	—	Barnaülsk	,, ,,			28 Feb.	,,		0·8651
352	—	Barnaülsk	,, ,,			15 Mar.	,,	—	0·8652

XXXII.—*continued.*

App. xxxii.

Table I. (*Supplementary*).

Collected by Government Dairy Instructors—*continued.*

OF TOMSK.

Water.	Ash.	Fat.	Refraction. Zeiss.	Melting Point.	Acidity.	Reichert-Wollny No.	Koettstorfer No.	Iodine No.	Hehner No.	No. in Table I.	No.
Per Cent.	Per Cent.	Per Cent.		Degrees, C.							
13·25	0·89	84·8	44·1	32·0	3·8	26·5	—	—	—	147	314
12·7	1·2	84·3	43·2	32·5	5·7	25·9	—	—	—	148	315
14·87	0·9	82·7	44·0	32·0	8·4	26·51	—	—	—	149	316
11·92	0·95	86·3	43·5	32·5	7·3	26·0	—	—	—	150	317
11·25	1·02	86·4	42·9	31·0	5·7	26·8	—	—	—	151	318
13·7	0·92	85·7	43·2	32·0	8·3	25·7	—	—	—	152	319
11·84	2·22	85·06	43·5	34·2—36·6	0·99	28·2	225·06	35·61	88·13	334	320
12·34	1·37	84·95	44·7	35·5—38·3	1·25	24·9	221·05	40·22	89·58	335	321
10·60	2·11	86·20	44·8	34·3—37·8	1·04	24·7	221·27	39·80	89·91	336	322
11·56	1·75	85·70	45·1	34·2—37·2	1·22	24·0	221·04	41·83	90·24	337	323
10·07	1·61	87·16	45·2	35·6—38·8	0·94	24·4	220·16	41·30	89·73	338	324
9·52	2·62	87·06	46·0	35·2—39·2	1·00	23·4	218·04	44·85	90·24	339	325
10·18	1·82	87·01	44·2	36·3—38·4	1·39	25·7	221·48	39·40	89·36	—	326
10·42	2·51	85·87	43·4	32·6 35·8	0·81	29·1	227·97	36·13	88·02	—	327
10·71	2·76	85·28	44·2	34·2—37·0	0·97	28·9	225·93	37·27	88·12	—	328
11·17	2·71	84·79	43·3	34·0—37·5	1·10	28·6	227·48	35·14	88·01	—	329
10·04	2·83	86·07	44·2	34·8—37·5	1·42	28·9	223·80	37·84	—	—	330
10·22	1·96	86·74	44·0	37·4—40·8	1·55	28·7	224·61	37·18	89·14	—	331
15·1	1·1	82·2	42·9	32·5	7·2	26·34	—	—	—	153	332
13·4	1·01	84·7	43·2	32·5	3·3	26·0	—	—	—	154	333
9·59	1·64	87·81	42·6	34·4—36·4	0·97	29·2	227·44	31·75	87·88	330	334
11·76	1·91	85·90	43·2	34·8—37·2	1·10	27·8	224·46	34·36	88·80	331	335
8·47	2·13	88·79	43·6	36·0—38·4	1·40	26·4	224·47	34·87	88·98	332	336
11·61	1·66	85·42	44·0	32·1—40·5	1·39	26·0	223·08	36·82	88·84	333	337
9·56	1·39	88·40	45·2	33·8—37·3	1·04	24·7	221·31	42·13	90·13	340	338
11·86	1·46	85·55	44·1	35·4—38·9	3·16	25·5	220·51	37·71	89·54	—	339
8·78	2·66	88·30	44·95	35·8—37·7	1·70	23·7	218·86	40·33	88·29	—	340
9·50	2·18	87·53	44·2	35·2—38·8	1·09	28·7	223·35	37·95	88·80	—	341
9·62	2·19	87·47	44·0	36·8—40·2	1·54	27·4	225·67	37·13	89·06	—	342
10·07	1·33	87·61	43·5	35·5—38·6	1·70	29·9	227·23	35·44	88·46	—	343
9·89	1·36	86·33	43·3	34·8—37·6	1·44	27·1	224·20	34·15	88·46	327	344
10·55	1·05	87·19	43·1	35·0—39·9	1·36	28·8	224·57	33·41	88·49	328	345
10·66	1·88	86·46	43·2	33·4—39·8	1·62	26·9	224·63	34·10	88·59	329	346
9·70	1·49	87·70	43·2	29·9—35·8	1·98	27·7	226·31	33·43	88·62	—	347
—	1·18	—	44·4	30·6—37·2	1·95	29·4	225·86	39·36	—	—	348
—	1·54	—	43·5	32·4—38·5	3·22	26·6	223·06	34·54	—	—	349
9·07	1·66	88·25	43·25	33·8—37·0	2·34	27·6	223·43	34·53	88·62	—	350
9·36	1·62	87·93	43·25	33·4—36·8	2·26	27·2	222·89	34·45	88·29	—	351
9·23	1·61	88·16	43·15	34·5—36·6	2·42	26·9	222·82	34·38	18·37	—	352

App. xxxii.

Table I.
(*Supplementary*).

RESULTS of Analyses of Samples of Butter

(5) IN THE GOVERNMENT

No.	No. in Table I.	District.	Village or Farm.	"Farm" or "Collected" Milk.	Food.	Date of Butter-making.	Brand of Butter.	Was Cream Pasteurised?	Specific Gravity of Sample at 100° C.
						1902:			
353	—	Barnaülsk	Kashinsk Association Dairy.	—	—	31 Mar.	Export	—	0·8652
354	—	Barnaülsk	,, ,,	—	—	15 April	,,	—	0·8653
355	—	Barnaülsk	,,	—	—	30 April	,,	—	0·8655
356	—	Barnaülsk	Dairy "Karl Golbek."	—	—	30 Feb.	—	—	0·8650
357	—	Barnaülsk	,, ,,	—	—	15 Mar.	—	—	0·8653
358	—	Barnaülsk	,, ,,	—	—	31 Mar.	—	—	0·8651
359	—	Barnaülsk	,, ,,	—	—	12 April	—	—	0·8658
360	—	Barnaülsk	V. Marinenskoe	—	—	14 May	Export	—	0·8652
361	—	Barnaülsk	V. Yarkovskoe	—	—	8 May	,,	—	0·8656
362	—	Barnaülsk	Marinenskoe	—	—	18 June	—	—	0·8662
363	—	Barnaülsk	Souminskoe	—	—	18 June	—	—	0·8662
364	—	Barnaülsk	Yarki	—	—	17 July	—	—	0·8661
365	—	Barnaülsk	,,	—	—	19 June	—	—	0·8661
						1901:			
366	341	Zneinogorods	Novo-Shipounovsk Association Dairy.		—	19 Dec.	—	—	0·8658
367	342	Zneinogorods	,, ,,	—	—	31 Dec.	—	—	0·8660
						1902:			
368	343	Zneinogorods	,, ,,	—	—	15 Jan.	—	—	0·8659
369	—	Zneinogorods	,, ,,	—	—	31 Jan.	—	—	0·8658
370	—	Zneinogorods	,, ,,	—		15 Feb.	—	—	0·8654
371	—	Zneinogorods	,, ,,	—	—	28 Feb.	—	—	0·8652
372	—	Zneinogorods	,, ,,	—	—	15 Mar.	—	—	0·8651
373	—	Zneinogorods	,, ,,	—	—	31 Mar.	—	—	0·8650
374	—	Zneinogorods	,, ,,	—	—	15 April	—	—	0·8653
375	—	Zneinogorods	,, ,,	—	—	30 April	—	—	0·8651
376	—	Zneinogorods	,, ,,	—	—	14 May	Export	—	—
377	—	Altaisk prov. Zmeinagorsk.	,, ,,	—	—	—	—	—	—
378	—	Altaisk prov. Zmeinagorsk.	,, ,,	—	—	—	—	—	—

App. xxxii.

Table I. (*Supplementary*).

XXXII.—*continued.*

Collected by Government Dairy Instructors—*continued.*

OF TOMSK—*continued.*

Water.	Ash.	Fat.	Refraction. Zeiss.	Melting Point.	Acidity.	Reichert-Wollny No.	Koettstorfer No.	Iodine No.	Hehner No.	No. in Table I.	No.
Per Cent.	Per Cent.	Per Cent.		Degrees, C.							
9·17	1·65	88·09	43·35	33·7—36·3	2·35	26·3	223·73	34·50	88·50	—	353
9·24	1·53	88·16	43·25	33·2—36·9	2·50	26·4	222·88	34·50	88·46	—	354
8·39	1·52	89·04	43·35	33·0—36·6	2·62	27·2	223·31	24·52	88·06	—	355
10·68	1·99	86·07	44·2	34·8—36·0	1·01	25·3	220·85	37·28	89·54	—	356
9·11	2·51	87·32	43·2	35·4—36·6	0·99	27·4	222·95	36·99	88·83	—	357
11·02	2·41	85·36	43·7	34·2—36·9	1·10	25·2	222·13	37·35	89·36	—	358
8·53	2·08	88·32	43·7	33·8—37·5	1·18	26·1	223·62	37·12	88·97	—	359
9·12	2·39	87·83	44·2	34·8—37·6	1·13	28·5	223·56	37·09	88·81	—	360
8·03	2·20	88·56	44·2	31·8—40·5	1·06	28·8	223·02	37·85	88·75	—	361
9·62	1·41	88·20	43·1	34·4—37·4	2·10	29·6	229·01	34·26	88·03	—	362
10·58	2·11	86·80	43·4	34·8—38·2	2·00	30·0	228·11	35·30	88·21	—	363
9·82	2·32	86·72	43·5	34·8—38·0	2·00	29·1	227·05	36·33	88·64	—	364
13·24	1·36	84·15	43·0	35·8—37·2	2·01	29·9	229·16	34·37	88·20	—	365
10·05	2·04	86·77	43·6	32·1—38·6	0·95	26·7	224·00	36·05	88·60	341	366
10·58	1·43	86·84	43·8	34·2—36·5	0·89	26·3	223·04	36·03	89·00	342	367
10·51	1·36	87·06	43·7	31·8—37·8	1·09	26·2	223·26	36·00	88·70	343	368
9·24	0·94	88·89	43·7	32·9—37·1	1·51	26·2	224·04	35·89	88·47	—	369
11·82	0·46	86·77	43·95	33·8—36·6	3·43	26·6	221·66	37·57	88·77	—	370
11·77	0·56	86·89	44·1	34·6—37·4	2·60	26·2	221·59	37·54	89·14	—	371
9·69	1·50	88·00	44·3	32·7—37·6	2·10	25·7	221·71	37·23	89·12	—	372
9·00	1·03	89·05	44·2	33·6—36·8	1·98	24·2	221·38	36·47	89·84	—	373
9·24	1·09	88·67	44·3	34·4—38·7	1·57	26·3	221·74	37·35	89·63	—	374
8·71	1·10	89·48	44·4	33·8—39·2	1·65	26·5	222·06	37·44	88·67	—	375
—	1·52	—	43·6	32·8—36·5	1·10	29·3	228·78	36·84	—	—	376
—	2·47	—	43·2	36·4—40·2	1·80	30·3	226·37	33·54	—	—	377
—	1·09	—	44·0	35·0—37·8	3·06	29·0	225·42	37·67	—	—	378

App. xxxii.

Table I. (*Supplementary*).

RESULTS of Analyses of Samples of Butter

(6) IN THE GOVERNMENT OF

No.	No. in Table I.	District.	Village or Farm.	"Farm" or "Collected" Milk.	Food.	Date of Butter-making.	Brand of Butter.	Was Cream Pasteurised?	Specific Gravity of Sample at 100° C.
						1902:			
379	—	St. Nikolaevsk Volchiy poselok.	—	—	—	20 May	Export	—	0·8662
380	—	St. Nikolaevsk Volchiy poselok.	—	—	—	25 May	"	—	0·8663
381	—	St. Nikolaevsk Volchiy poselok.	—	—	—	4 June	"	—	0·8660
382	—	St. Nikolaevsk Volchiy poselok.	—	—	—	10 June	"	—	0·8662
383	—	St. Nikolaevsk Volchiy poselok.	—	—	—	17 June	"	—	0·8661
384	—	St. Nikolaevsk Volchiy poselok.	—	—	—	27 June	"	—	0·8658
385	—	St. Nikolaevsk Volchiy poselok.	—	—	—	3 July	"	—	0·8655
386	—	St. Nikolaevsk Volchiy poselok.	—	—	—	9 July	"		—
387	—	St. Nikolaevsk Volchiy poselok.	—	—	—	16 July	"	—	—
388	—	St. Nikolaevsk Volchiy poselok.	—	—	—	23 July	"	—	—
389	—	St. Nikolaevsk Volchiy poselok.	—	—	—	30 July	"	—	—

31st December 1902.

XXXII—*continued.*

Collected by Government Dairy Instructors—*continued.*

OMSK AND THE AKMOLINSKY PROVINCE.

Water.	Ash.	Fat.	Refraction. Zeiss.	Melting Point.	Acidity.	Reichert-Wollny No.	Koettstorfer No.	Iodine No.	Hehner No.	No. in Table I.	No.
Per Cent.	Per Cent.	Per Cent.		Degrees, C.							
11·02	3·24	84·74	43·35	34·4—36·4	0·79	28·8	227·48	35·72	86·16	—	379
10·49	2·94	85·50	43·45	34·6—36·9	0·91	28·8	227·60	34·78	87·86	—	380
12·16	2·28	84·29	43·6	35·2—38·7	1·44	30·6	226·01	36·12	88·50	—	381
11·65	3·65	83·76	43·5	34·8—38·2	1·37	29·5	227·11	35·77	88·22	—	382
10·70	1·72	86·38	42·7	34·2—37·0	1·40	29·9	229·87	32·80	87·37	—	383
9·83	1·84	87·24	43·3	36·4—40·6	2·27	29·1	227·19	34·22	88·46	—	384
11·85	2·64	84·54	42·9	36·4—40·2	1·67	30·2	227·93	32·98	—	—	385
—	2·77	—	43·6	36·2—40·5	2·08	29·3	224·98	35·25	—	—	386
—	2·39	—	43·7	36·6—40·2	3·28	29·1	224·97	35·84	—	—	387
—	2·41	—	44·1	37·2—41·4	2·81	28·3	222·59	36·58	—	—	388
—	1·80	—	43·5	35·6—39·5	3·27	28·4	225·74	35·31	—	—	389

Acting Principal of Department : A. BAKST.
Director : S. LENIN.

App. xxxii.
Table II.

APPENDIX, XXXII.—*continued.*

TABLE II.

REICHERT-WOLLNY NO. of 352 SAMPLES of RUSSIAN BUTTER.

The figures in italics indicate the date of the month.

November, 1901.	
1.	26·0
2.	24·3
3.	23·0
3.	22·1
5.	23·1
7.	23·1
8.	23·0
10.	22·7
10.	25·4
11.	26·5
11.	23·9
12.	26·1
12.	27·7
12.	26·0
14.	26·1
15.	25·0
15.	24·7
15.	25·3
16.	21·8
17.	26·1
19.	24·0
20.	26·5
20.	23·7
20.	23·7
20.	26·8
20.	23·8
22.	22·0
23.	26·4
24.	24·7
25.	26·3
25.	26·7
27.	26·5
29.	26·2
29.	26·7
29.	23·9
?	24·9
?	25·6
?	26·6
?	25·7
December, 1901.	
1.	24·0
3.	22·0
3.	27·0
4.	24·6
6.	24·1
7.	25·3
7.	25·6
10.	25·7
11.	23·5
12.	24·8
14.	25·4
14.	21·8
18.	24·0
18.	23·8
19.	26·7
21.	23·9
17.	27·1
19.	26·7
21.	24·7
21.	21·8
21.	23·2
28.	23·8
December—*cont.*	
?	24·6
?	24·8
?	24·7
?	25·6
?	23·7
31.	28·8
31.	26·3
January, 1902.	
1.	24·0
2.	23·1
3.	23·2
3.	26·3
3.	24·6
4.	24·7
4.	25·5
5.	23·7
6.	24·7
6.	23·8
7.	26·5
7.	26·4
8.	25·6
11.	25·7
14.	26·5
14.	29·4
15.	26·9
15.	26·2
15.	25·7
15.	23·3
17.	24·6
17.	24·8
18.	23·6
19.	25·7
19.	23·7
20.	24·6
20.	24·3
21.	23·2
21.	24·6
22.	24·7
23.	23·8
25.	25·6
25.	27·3
27.	24·8
29.	24·7
31.	26·2
?	26·5
?	25·9
?	26·5
?	26·0
?	26·8
?	25·7
February, 1902.	
1.	29·2
1.	27·7
1.	23·5
1.	23·8
3.	25·7
3.	23·0
3.	26·3
3.	25·3
February—*cont.*	
4.	27·8
5.	23·9
8.	30·3
10.	26·7
11.	27·9
14.	27·8
15.	26·8
15.	28·8
18.	28·8
18.	26·3
18.	26·1
19.	27·6
21.	27·8
22.	27·7
24.	26·0
25.	28·3
28.	29·4
28.	27·2
28.	26·2
March, 1902.	
1.	28·2
2.	26·2
4.	27·6
7.	28·2
8.	26·7
10.	29·4
10.	28·7
12.	25·7
14.	29·3
15.	28·5
15.	27·4
15.	26·4
15.	25·4
18.	27·7
18.	28·2
21.	24·9
21.	24·9
21.	29·8
22.	28·5
25.	28·4
26.	29·1
27.	29·3
28.	29·2
29.	26·1
31.	25·2
31.	26·3
31.	24·2
April, 1902.	
1.	29·3
2.	25·2
4.	26·8
4.	24·7
5.	24·7
6.	26·9
6.	24·0
8.	30·1
8	29·4
9.	25·5
10.	26·7
April—*cont.*	
10.	27·0
11.	26·4
11.	26·6
12.	24·4
12.	26·1
12.	28·1
12.	26·1
15.	26·4
15.	26·3
18.	24·4
18.	26·9
19.	27·0
22.	24·2
22.	27·6
23.	24·7
25.	23·4
25.	27·7
26.	26·1
26.	22·4
26.	28·8
29.	25·0
30.	26·9
30.	20·4
30.	27·2
30.	26·5
May, 1902.	
1.	26·2
2.	25·2
2.	29·1
3.	26·4
3.	25·1
4.	26·5
6.	25·7
6.	26·9
6.	28·9
7.	21·2
8.	28·8
9.	28·6
9.	25·0
9.	25·5
10.	24·2
10.	28·5
10.	25·5
11.	27·7
13.	26·3
13.	29·3
13.	23·2
14.	28·5
14.	29·3
14.	28·1
15.	28·7
15.	28·7
16.	28·0
17.	27·9
17.	29·0
17.	28·2
17.	25·4
18.	23·7
18.	28·0
19.	28·6
20.	28·8
22.	25·4
May—*cont.*	
23.	28·7
23.	28·7
23.	26·3
24.	27·9
24.	26·7
25.	29·0
25.	28·8
27.	27·1
27.	29·1
27.	28·9
28.	30·1
31.	28·1
31.	30·4
31.	28·7
31.	27·9
June, 1902.	
1.	27·9
3.	27·9
4.	29·0
4.	30·6
5.	26·8
7.	28·7
7.	29·2
7.	28·4
7.	28·5
7.	27·7
8.	28·3
8.	26·7
9.	28·0
9.	28·2
10.	29·9
10.	28·2
10.	29·2
10.	26·3
10.	29·5
13.	26·5
14.	30·3
14.	27·6
14.	26·7
14.	28·1
14.	28·1
15.	28·6
16.	29·4
17.	29·1
17.	29·9
18.	27·4
18.	29·6
18.	30·0
18.	27·4
19.	29·9
20.	28·6
20.	26·3
21.	29·1
22.	28·3
24.	28·8
25.	29·8
25.	27·5
26.	27·1
26.	28·3
26.	28·7
27.	29·1
27.	24·4
June—*cont.*	
29.	28·4
28.	26·1
July, 1902.	
2.	28·2
2.	28·9
3.	30·2
3.	27·5
4.	23·9
5.	28·5
5.	20·4
6.	29·5
7.	27·3
7.	27·9
9.	29·3
10.	26·7
12.	27·6
13.	23·8
13.	28·1
13.	27·5
14.	24·2
14.	24·7
16.	29·1
16.	29·3
17.	29·1
18.	24·2
18.	27·5
19.	28·0
20.	29·9
20.	28·7
23.	28·3
25.	25·6
25.	25·9
26.	27·5
26.	28·5
26.	24·6
27.	29·1
29.	29·0
30.	28·4
31.	27·9
31.	27·2
?	24·9
August, 1902.	
2.	25·6
2.	25·8
2.	24·7
6.	28·7
6.	24·5
6.	26·4
7.	27·2
8.	27·5
9.	24·9
9.	23·7
12.	27·3
19.	26·6
25.	26·1
26.	27·4

The R.W. No. of all samples taken in on the 30th of October, 1901, was 23·7.

App. xxxii.

Tables III.–IV.

APPENDIX, XXXII.—*continued.*

TABLE III.

RUSSIAN BUTTER. REICHERT-WOLLNY NOS. and their MONTHLY DISTRIBUTION.

A.

R.W. No.	1901.			1902.							
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.
Above 20	–	–	–	–	–	–	1	–	–	–	–
" 21	–	1	1	1	–	–	–	1	–	–	–
" 22	–	2	1	–	–	–	1	–	–	–	–
" 23	1	11	7	9	4	–	1	1	–	3	1
" 24	–	6	9	11	–	2	7	3	–	6	3
" 25	–	20	11	19	23	25	25	44	48	40	5
TOTAL	1	40	29	40	27	27	35	49	48	49	9
Percentage below 25	100	50	62	52·5	14·8	7·4	28·6	10·2	0	16·3	44·4

B.

R.W. No.	October to April.			October to August.		
	Number.	Percentage.		TOTAL.	Percentage of Total	
Above 20	1	0·5		1	0·3	
" 21	3	1·5	2·0	4	1·1	1·4
" 22	4	2·0	4·0	4	1·1	2·5
" 23	33	16·6	20·6	38	10·7	13·2
" 24	35	17·6	38·2	47	13·3	26·6
" 25	123	61·8		260	73·4	
TOTAL	199	100		354	99·9	
Percentage below 25 R.W.		38·2				26·6

TABLE IV.

MONTHLY AVERAGE, REICHERT-WOLLNY NO., of BUTTER from different RUSSIAN GOVERNMENTS.

DATE.	EUROPEAN RUSSIA.			SIBERIA.		Average.	Variation.
	Moguilev.	Yaroslavl.	Vologda.	Tobolsk.	Tomsk and Omsk.		
October 1901	23·5	—	—	—	—	23·5	—
November "	24·8	25·4	25·3	25·4	—	25·2	21·8—26·9
December "	23·8	24·9	25·1	25·0	27·2	25·2	21·8—28·8
January 1902	25·4	24·0	24·5	25·7	26·7	25·3	21·9—29·4
February "	26·9	30·3	25·5	—	26·5	27·3	23·0—30·3
March "	27·7	—	—	29·3	25·7	27·6	24·2—29·8
April "	26·7	—	—	25·6	25·8	26·0	20·4—30·1
May "	26·4	28·6	27·0	28·2	28·1	27·1	21·2—30·4
June "	27·2	27·9	29·5	28·3	21·1	28·4	24·4—30·6
July "	26·3	26·4	24·2	27·9	29·2	26·8	23·8—30·2
August "	25·1	25·9	—	27·1	—	26·0	23·7—27·5

App. xxxii.
Table V.

APPENDIX, XXXII.—*continued.*

TABLE V.

YAROSLAVL GOVERNMENT (RUSSIA).

A.

MONTHLY REICHERT-WOLLNY No. in different DISTRICTS.

Districts.	1901.		1902.					
	November.	December.	January.	February.	May.	June.	July.	August.
Poshekhonsk	20th 26·8	1st 24·0	2nd 23·1	8th 30·0	9th 28·6	8th 28·3	14th 24·7	—
	—	3rd 22·0	—	—	—	—	—	—
Romanovo-Borisogliebsk.	12th 24·7	6th 24·1	3rd 23·2	—	—	5th 26·8	5th 27·0	6th 24·7
	12th 26·9	7th 25·6	5th 23·7	—	—	—	—	—
	16th 21·8	—	5th 24·7	—	—	—	—	—
	17th 26·1	—	6th 23·8	—	—	—	—	—
	19th 24·0	—	19th 25·7	—	—	—	—	—
	22nd 22·0	—	19th 23·7	—	—	—	—	—
	—	—	20th 24·3	—	—	—	—	—
Lubimsk	8th 23·0	3rd 27·0	8th 25·6	—	—	10th 28·2	7th 27·3	7th 27·2
	15th 24·7	—	21st 24·6	—	—	10th 29·2	7th 27·9	8th 27·5
	25th 26·3	—	23rd 23·8	—	—	—	—	—
	25th 26·7	—	—	—	—	—	—	—

B.

MONTHLY AVERAGE REICHERT-WOLLNY NUMBER.

Districts.	1901.		1902.					
	November.	December.	January.	February.	May.	June.	July.	August.
Poshekhonsk	26·8	23·0	23·1	30·3	28·6	28·3	24·7	—
Romanovsk	24·2	24·8	24·2	—	—	26·8	27·0	24·5
Lubimsk	25·2	27·0	24·7	—	—	28·7	27·6	27·3

C.

MONTHLY FLUCTUATIONS OF REICHERT-WOLLNY NUMBER.

R. W. No.	1901.		1902.						TOTAL.
	November.	December.	January.	February.	May.	June.	July.	August.	
Above 20	—		—	—	—	—	—	—	—
„ 21	1	—	—	—	—	—	—	—	1
„ 22	1	1	—	—	—	—	—	—	2
„ 23	1	—	6	—	—	—	—	—	7
„ 24	3	2	3	—	—	—	1	1	10
„ 25	5	2	2	1	1	4	3	2	20
TOTAL	11	5	11	1	1	4	4	3	40

App. xxxii.
Table VI.

APPENDIX XXXII.—*continued.*

TABLE VI.

REICHERT-WOLLNY No. of SAMPLES of BUTTER from the VOLOGDA GOVERNMENT (EUROPEAN RUSSIA).

A.

FARM BUTTER.		Average.	COLLECTED BUTTER.		Average.
10th November 1901 - -	22·7	24·4	10th November 1901 -	25·4	25·7
12th „ „ - -	26·1		11th „ „ -	26·5	
			20th „ „ -	23·8	
			29th „ „ -	26·2	
			29th „ „ -	26·7	
4th December „ - -	24·6	25·0	7th December „ -	25·3	25·3
4th „ „ -	25·3				
2nd January 1902 - -		24·3	3rd January 1902 - -	24·6	24·7
3rd „ „ - -	26·3		4th „ „ - -	24·7	
17th „ „ - -	24·6		17th „ „ - -	24·8	
3rd February „ - -	26·3	26·3	1st February „ - -	23·8	23 8
			11th May „ - -	27·7	27 0
			13th „ „ - -	26·3	
			9th June „ - -	28·2	29·5
			10th „ „ - -	29·9	
			14th July „ - -	24·2	24·2

B.

R. W. No.	1901.		1902.					TOTAL.
	November.	December.	January.	February.	May.	June.	July.	
Above 20 - - -	.	—	—	—	—	—	—	—
„ 21 - - -	—	—	1	—	—	—	—	1
„ 22 - - -	1	—	—	—	—	—	—	1
„ 23 - - -	1	—	—	1	—	—	—	2
„ 24 - - -	—	1	4	—	—	—	1	6
„ 25 - - -	5	2	1	1	2	2	—	13
TOTAL - - -	7	3	6	2	2	2	1	23

App. xxxii.
Table VII.

APPENDIX XXXII.—*continued.*

TABLE VII.

REICHERT-WOLLNY No. of SAMPLES of BUTTER from different ESTATES in the MOGUILEV GOVERNMENT (EUROPEAN RUSSIA) from OCTOBER 1901 to AUGUST 1902.

A.

ZHDANOVICHI.		GOLOVCHIN.		TOLOCHINO.		SKRINSHCHINA.		OTHER ESTATES.	
								3 Oct.	23·5
		1 Nov.	26·0					2 Nov.	24·3
		14 ,,	26·1					3 ,,	23·0
		20 ,,	26·5					3 ,,	22·1
								5 ,,	23·1
								7 ,,	23·1
								11 ,,	23·9
								15 ,,	25·3
								20 ,,	23·7
								20 ,,	23·7
								23 ,,	23·3
								23 ,,	26·4
18 Dec.	24·0	11 Dec.	23·5	21 Dec.	24·7	14 Dec.	21·8		
21 ,,	23·9	18 ,,	23·8	28 ,,	23·8	21 ,,	23·0		
		? ,,	24·6			21 ,,	23·2		
		? ,,	24·8						
1 Jan.	24·0	15 Jan.	23·3	25 Jan.	27·3	4 Jan.	25·5		
7 ,,	26·4	22 ,,	24·7			11 ,,	25·7		
11 ,,	26·5	27 ,,	24·8			18 ,,	23·6		
21 ,,	23·2					25 ,,	25·6		
29 ,,	24·7								
5 Feb.	23·9	3 Feb.	23·0	14 Feb.	27·8	1 Feb.	23·5		
14 ,,	27·9	10 ,,	26·7	21 ,,	27·8	15 ,,	28·8		
18 ,,	28·8	18 ,,	26·3	28 ,,	29·4	22 ,,	27·7		
25 ,,	28·3	24 ,,	26·0						
4 Mar.	27·6	2 Mar.	26·2	7 Mar.	28·2	1 Mar.	28·2		
11 ,,	28·7	12 ,,	25·7	14 ,,	29·3	8 ,,	26·7		
18 ,,	28·8	18 ,,	27·7	21 ,,	29·8	15 ,,	28·5		
25 ,,	28·4	27 ,,	26·7	28 ,,	29·2	22 ,,	28·5		
						29 ,,	26·1		
1 April	29·3	2 April	25·2	4 April	26·8	6 April	26·9		
8 ,,	30·1	8 ,,	25·9	11 ,,	26·6	12 ,,	28·1		
22 ,,	27·6	18 ,,	24·4	18 ,,	26·9	19 ,,	27·0		
30 ,,	26·9	26 ,,	22·9	25 ,,	27·7	26 ,,	26·1		
		30 ,,	20·4						
6 May	26·9	7 May	21·2	2 May	25·2	3 May	26·4		
14 ,,	28·1	13 ,,	23·2	9 ,,	25·0	10 ,,	24·2		
19 ,,	28·6	22 ,,	25·4	16 ,,	28·0	17 ,,	25·4		
26 ,,	28·8	27 ,,	27·1	23 ,,	26·3	24 ,,	27·9		
				31 ,,	29·1	31 ,,	30·4		
3 June	27·9	10 June	26·3	7 June	28·7	7 June	29·2		
14 ,,	26·7	25 ,,	27·5	13 ,,	26·5	14 ,,	27·6		
17 ,,	29·1			20 ,,	26·3	21 ,,	29·1		
28 ,,	27·1			27 ,,	24·4	28 ,,	28·4		
2 July	28·2	13 July	23·8	4 July	23·9	5 July	28·5		
10 ,,	27·6	25 ,,	25·6	? ,,	24·9				
25 ,,	25·9			18 ,,	24·2				
				26 ,,	24·6				
6 Aug.	26·4			2 Aug.	24·7	12 Aug.	27·3		
25 ,,	26·1			9 ,,	23·7	19 ,,	26·8		
						26 ,,	27·4		
						2 ,,	25·8		
						9 ,,	24·9		

App. xxxii.
Table VII.

Appendix XXXII.—*continued.*

Table VII.—*continued.*

Reichert-Wollny No. of Samples of Butter from different Estates, &c.—*continued.*

B.

Months, 1901–2.	Zhdanovichi.	Golovchin.	Skrinshchina.	Tolochino.	Other Estates.	Average.
October	—	—	—	—	23·5	23·5
November	—	—	—	26·2	23·8	24·5
December	24·0	24·2	22·7	24·2	—	23·8
January	25·0	27·3	25·1	24·3	—	25·4
February	27·2	28·3	26·7	25·5		26·9
March	28·2	29·1	27·0	26·6	—	27·7
April	28·5	27·0	27·0	24·4	—	26·7
May	28·1	26·5	26·9	24·2	—	26·4
June	27·7	26·5	27·6	26·9	—	27·2
July	27·9	24·4	27·5	24·7		26·9
August	26·1	24·2	25·3		—	25·2

C.

R.W. No.	1901.			1902.								Total
	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	
Above 20	—	—	—	—	—	—	1		—			1
„ 21	—	—	1	—	—	—	—	1	—		.	2
„ 22	—	—		—	—	—	1	—	—	—	.	1
„ 23	1	8	6	3	3	—	—	1	.	3	1	26
„ 24	—	1	4	4	—	—	1	1	—	4	2	17
„ 26	—	5		5	11	17	14	15	14	11	1	93
Total	1	14	11	12	14	17	17	18	14	18	4	140

App. xxxii.
Table VIII.

APPENDIX XXXII.—*continued.*

TABLE VIII.

(TOMSK AND OMSK GOVERNMENTS), SIBERIA.

REICHERT-WOLLNY NO. of SAMPLES of SIBERIAN BUTTER (December 1901 to July 1902).

A.

TOMSK GOVERNMENT.										OMSK GOVERNMENT.	
KAINSK DISTRICT.				BARNAULSK DISTRICT.				ZMIEINOGORSK DISTRICT.		AKMOLINSK DISTRICT.	
A. Alexandrinsk Dairy.		B. Different Dairies.		C. Different Dairies.		D. Kashinsk Co-operative Dairy.		E. Novo-Shipulinsk Dairy.		F.	
						17 Dec.	27·1	19 Dec.	26·7		
						31 ,,	28·8	31 ,,	26·3		
Jan. and Feb.	26·5					14 Jan.	29·4	15 Jan.	26·2		
	25·9					15 ,,	26·9	31 ,,	26·2		
	26·5					20 ,,	26·6				
	26·0	1 Feb.	29·2	30 Feb.	25·3	1 Feb.	27·7	15 Feb.	26·5		
	26·8	4 ,,	27·8			19 ,,	27·6	28 ,,	26·2		
	25·7	19 ,,	26·0			28 ,,	27·2				
21 Mar.	24·9			15 Mar.	27·4	15 Mar.	26·9	15 Mar.	25·7		
				31 ,,	25·2	31 ,,	26·3	31 ,,	24·2		
5 April	24·7	4 April	24·7	12 April	26·1	15 April	26·4				
6 ,,	24·0	11 ,,	26·4			30 ,,	27·2				
12 ,,	24·4										
25 ,,	23·4										
6 May	25·7	9 May	25·5	8 May	28·8			14 May	29·3	20 May	28·8
27 ,,	29·1	15 ,,	28·7	14 ,,	28·5					25 ,,	28·8
27 ,,	28·9	18 ,,	23·4	15 ,,	28·7						
20 June	28·6	18 June	27·4	18 June	27·4			14 June	30·3	4 June	30·6
				18 ,,	29·6					10 ,,	29·5
				18 ,,	30·0					17 ,,	29·9
				19 ,,	29·9					27 ,,	29·1
2 July	28·9	20 July	29·9	16 July	29·3			29 July	29·0	3 July	30·2
20 ,,	28·7			17 ,,	29·1					9 ,,	29·3
				20 ,,	29·9					16 ,,	29·1
										23 ,,	28·3
										30 ,,	28·4

B.

Month, 1901-2.	CORRESPONDING COLUMNS IN ABOVE TABLE.						Average.
	A.	B.	C.	D.	E.	F.	
December	—	—	—	28·0	26·5	—	27·7
January	—	—	—	27·6	26·2	—	26·9
February	—	27·7	25·3	27·5	26·4	—	26·7
March	24·9	—	26·3	26·6	25·0	—	25·7
April	24·1	25·5	26·1	26·8	26·4	—	25·6
May	27·9	26·0	28·7	—	29·3	28·8	28·1
June	28·6	27·4	29·2	—	30·3	29·8	29·1
July	28·8	29·9	29·4	—	29·0	29·1	29·2

C.

R.W. No.	1901.	1902.							Total.
	Dec	Jan.	Feb	Mar.	April.	May.	June.	July.	
Above 20	—	—	—	—	—	—	—	—	—
,, 21	—	—	—	—	—	—	—	—	—
,, 22	—	—	—	—	—	—	—	—	—
,, 23	—	—	—	—	1	1	—	—	2
,, 24	—	—	—	2	4	—	—	—	6
,, 25	4	10	10	5	6	11	11	12	69
TOTAL	4	10	10	7	11	12	11	12	77

App. xxxii.
Table IX.

APPENDIX, XXXII.—*continued.*

TABLE IX.

REICHERT-WOLLNY VALUE of SAMPLES of SIBERIAN BUTTER (November 1901 to August 1902).

A.

DISTRICTS IN TOBOLSK GOVERNMENT.

KOURGHANSK.				YALUTOROVSK.		TSHIMSK.		JUKALINSK.	
A. Mitinsk Dairy.		B. Malo-Dubrovsk Dairy.		C. Sonersk Dairy.		D. Outchansk and Alexandrovsk Dairies.		E. Different Dairies	
15 Nov.	25·0			? Date	24·9				
24 ,,	24·7				25·6				
27 ,,	26·5				26·6				
30 ,,	23·9				25·7				
10 Dec.	25·7			? Date	24·7				
12 ,,	24·8				25·6				
14 ,,	25·4				23·7				
				15 Jan.	25·7				
27 Mar.	29·3	26 Mar.	29·1	10 Mar.	29·4				
10 April	27·0	9 April	25·5			12 April	26·1		
22 ,,	24·2	10 ,,	26·7			23 ,,	24·7		
		29 ,,	25·0						
1 May	26·2	6 May	28·9	3 May	25·1	2 May	29·0	17 May	27·9
4 ,,	26·5	17 ,,	29·0	10 ,,	25·5	13 ,,	29·3	23 ,,	28·7
10 ,,	28·5	23 ,,	28·7	18 ,,	28·0	28 ,,	30·1		
17 ,,	28·2	31 ,,	27·9	25 ,,	29·0				
24 ,,	26·7								
31 ,,	28·7								
7 June	27·7	7 June	28·5	1 June	27·9	7 June	28·4	4 June	29·0
14 ,,	28·1	14 ,,	28·1	8 ,,	26·7	26 ,,	28·3	9 ,,	28 0
26 ,,	28·7			22 ,,	28·3	15 ,,	28·6	16 ,,	29·4
28 ,,	26·1					24 ,,	28·8	25 ,,	29·8
5 July	26·4	20 July	28·4	13 July	27·5	6 July	29·5		
12 ,,	27·6	27 ,,	29·1			19 ,,	28·0		
18 ,,	27·5					31 ,,	27·9		
26 ,,	26·5					3 ,,	27·5		
31 ,,	27·2					13 ,,	28·1		
						26 ,,	27·5		
				2 Aug.	25·6	6 Aug.	28·7		

B.

Months, 1901-2.	CORRESPONDING COLUMNS IN ABOVE TABLE.					Average.
	A.	B.	C.	D.	E.	
November	25·0	—	25·7	—	—	25·4
December	25·3	—	24·7	—	—	25·0
January	—	—	25·7	—	—	25·7
February	—	—	—	—	—	—
March	29·3	29·1	29·4	—	—	29·3
April	25·6	25·7	—	25·4	—	25·6
May	27·5	28·6	26·9	29·5	28·3	28·2
June	27·9	28·3	27·6	28·5	29·0	28·3
July	27·0	28·7	27·5	28·1	—	27·8
August	—	—	25·6	28·7	—	27·1

C.

R.W. No.	1901.		1902.								TOTAL.
	Nov.	Dec.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	
Above 20	–	–	–	–	–	–	–	–	–	–	–
,, 21	–	–	–	–	–	–	–	–	–	–	–
,, 22	–	–	–	–	–	–	–	–	–	–	–
,, 23	1	1	–	–	–	–	–	–	–	–	2
,, 24	2	2	–	–	–	2	–	–	–	–	6
,, 25	5	3	1	–	3	5	19	17	14	2	69
TOTAL	8	6	1	–	3	7	19	17	14	2	77

Percentage below 25 Reichert-Wollny :—For the year, 11·6 per cent. ; from November 1901 to April 1902, 32 per cent.

App. xxxii.
Table X.

APPENDIX XXXII.—*continued.*

TABLE X.

SHOWING THE REICHERT-WOLLNY VALUE AND THE PRICE.

MONTHS, 1901–1902.	SIBERIAN BUTTER.				RUSSIAN BUTTER.	
	Barnaul.		Kourghan.		Vologda.	
	R.W. No.	Price per Cwt.	R.W. No.	Price per Cwt.	R.W. No.	Price per Cwt.
		s. d.		*s. d.*		*s. d.*
October	—	88 –	—	96 1	—	Sold on the spot from 103*s.* to 116*s.* per cwt.
November	—	90 6	25·0	93 7	25·3	
December	28·0	94 3	25·3	—	25·1	
January	27·6	97 5	–	103 5	24·5	
February	26·4	96 –	—	99 3	25·5	100 5
March	28·4	97 7	29·2	91 1	–	99 –
April	26·4	89 –	25·6	90 6	—	93 –
May	28·7	86 5	28·0	89 6	27·0	90 4
June	29·2	81 –	28·1	88 2	29·5	87 8
July	29·4	80 9	27·8	88 3	24·2	83 7

App. xxxii.
Tables XI.–XIII.

Appendix XXXII.—*continued.*

TABLE XI.*

The Refractive Index of Russian and Siberian Butter.

Months.	Average.	Fluctuation.
October 1901	43·4	42·6—44·5
November ,,	43·6	42·4—44·8
December ,,	43·4	42·1—44·8
January 1902	43·1	42·0—44·3
February ,,	43·4	42·1—44·3
March ,,	43·7	42·5—44·7
April ,,	44·3	42·9—46·6
May ,,	44·2	43·1—46·1
June ,,	44·7	42·7—45·8
July ,,	44·3	42·9—46·2
August ,,	45·1	43·7—45·6

TABLE XII.*

Russian and Siberian Butter.

Monthly Fluctuation of Hübl's Iodine Figures.

Months.	Average.	Fluctuation.
December 1901	34·9	33·4—36·0
January 1902	36·6	34·0—39·7
February ,,	35·8	31·7—39·6
March ,,	36·4	30·9—40·2
April ,,	38·3	33·1—47·9
May ,,	39·8	34·0—47·6
June ,,	38·3	32·9—48·5
July ,,	38·4	32·2—46·6
August ,,	41·5	34·0—47·4

TABLE XIII.*

Russian and Siberian Butter, showing the Hehner value.

Months.	Average.	Fluctuation.
December 1901	88·6	88·5—89·0
January 1902	88·6	88·6—88·7
February ,,	88·5	87·9—89·1
March ,,	88·4	87·4—89·8
April ,,	89·7	87·9—90·4
May ,,	88·7	87·7—90·3
June ,,	88·6	87·2—89·6
July ,,	88·9	88·5—89·4

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* The Russian samples from the Vologda, Yaroslavl, and Moguilsvek. The Siberian samples from the Tobolsk and Omsk Governments, and from the Akmolinsk District. The above tables are summaries of figures which have been supplied in detail.

Appendix XXXIII.

APPENDIX, No. XXXIII.

HANDED in by Major P. G. Craigie, C.B.

TABLES SHOWING IMPORTS OF BUTTER.

IMPORTS of BUTTER into the UNITED KINGDOM from FOREIGN COUNTRIES and BRITISH POSSESSIONS, for the Years 1896–1902 inclusive.

I. QUANTITIES.

COUNTRIES.	1896.	1897.	1898.	1899.	1900.	1901.	1902.
	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.
Denmark	1,228,784	1,334,726	1,465,030	1,430,052	1,486,342	1,597,186	1,703,032
Russia	151,805	198,690	180,333	138,938	209,738	378,452	490,091
France	467,602	448,128	416,821	353,942	322,048	311,601	414,240
Holland	234,469	278,631	269,324	284,810	282,805	298,912	393,261
Sweden	323,829	299,214	294,962	245,599	196 041	180,212	191,591
United States	141,553	154,196	66,712	159,137	56,046	150,126	54,458
Belgium	38,132	30,518	36,384	62,032	78,771	77,526	80,636
Germany	107,825	51,761	41,231	36,953	36,042	26,983	26,375
Norway	17,075	28,212	27,138	30,965	26,085	26,341	26,266
Argentina	15,763	10,860	14,729	20,121	27,098	22,787	69,336
Italy	1,359	1,349	293	—	857	489	5
Other Foreign Countries	73	24	779	195	63	290	607
TOTAL FOREIGN COUNTRIES	2,728,269	2,836,309	2,813,736	2,762,744	2,721,936	3,070,905	3,449,898
Canada	88,357	109,402	156,865	250,083	138,313	215,588	285,765
Australia	163,775	194,353	167,205	264,169	353,157	248,168	80,397
New Zealand	56,373	76,522	69,949	111,639	163,871	167,343	157,993
British East Indies	570	828	983	686	1,045	882	863
Other British Possessions	374	388	415	530	194	4	17
TOTAL BRITISH POSSESSIONS	309,449	381,493	395,417	627,107	656,580	631,985	525,035
TOTAL	3,037,718	3,217,802	3,209,153	3,389,851	3,378,516	3,702,890	3,974,933

II. VALUES.

COUNTRIES.		1896.	1897.	1898.	1899.	1900.	1901.	1902.
		£.	£.	£.	£.	£.	£.	£.
Denmark		6,288,413	6,748,163	7,359,831	7,553,436	8,029,625	8,950,497	9,302,362
Russia		755,080	970,264	880,626	685,493	980,770	1,655,352	2,196,234
France		2,537,695	2,330,576	2,183,845	1,908,848	1,785,504	1,704,128	2,233,122
Holland		1,156,726	1,353,349	1,329,458	1,417,641	1,414,441	1,511,564	1,973,930
Sweden		1,664,685	1,515,705	1,501,668	1,246,137	1,013,775	938,889	995,838
United States		617,525	633,549	285,309	704,061	247,724	689,164	252,874
Belgium		190,544	151,920	174,244	283,811	367,106	379,020	399,381
Germany		536,246	263,097	214,046	186,573	190,820	150,206	145,399
Norway		82,263	138,199	135,794	153,937	131,415	142,038	139,262
Argentina		73,927	52,638	71,415	100,332	130,111	113,656	351,412
Italy		7,206	6,904	1,572	—	4,213	2,767	25
Other Foreign Countries		304	123	2,930	817	293	1,261	2,565
TOTAL FOREIGN COUNTRIES	£.	13,910,614	14,164,487	14,140,738	14,241,086	14,295,797	16,238,542	17,992,404
Canada		339,744	444,862	661,935	1,113,956	640,760	1,008,002	1,347,345
Australia		812,938	936,559	815,891	1,310,525	1,725,401	1,227,447	402,094
New Zealand		277,898	366,956	338,400	543,367	784,054	819,534	781,872
British East Indies		1,334	2,156	2,719	2,000	3,483	3,846	2,883
Other British Possessions		1,836	1,897	2,100	2,582	940	25	92
TOTAL BRITISH POSSESSIONS	£.	1,433,750	1,752,430	1,821,045	2,972,430	3,154,638	3,058,854	2,534,286
TOTAL		15,344,364	15,916,917	15,961,783	17,213,516	17,450,435	19,297,396	20,526,690

Appendix, No. XXXIII.—*continued.*

IMPORTS of BUTTER from FOREIGN COUNTRIES and BRITISH POSSESSIONS, for the Years 1896–1902 inclusive.

III. PERCENTAGE OF QUANTITY IMPORTED FROM EACH COUNTRY.

COUNTRIES.	1896.	1897.	1898.	1899.	1900.	1901.	1902.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Denmark	40·45	41·48	45·65	42·19	43·99	43·13	42·85
Russia	5·00	6·17	5·62	4·10	6·21	10·22	12·33
France	15·39	13·93	12·99	10·44	9·53	8·42	10·42
Holland	7·72	8·66	8·39	8·40	8·37	8·07	9·89
Sweden	10·66	9·30	9·19	7·25	5·80	4·87	4·82
United States	4·66	4·79	2·08	4·69	1·66	4·05	1·37
Belgium	1·26	0·95	1·13	1·83	2·33	2·09	2·03
Germany	3·55	1·61	1·28	1·09	1·07	0·73	0·66
Norway	0·56	0·88	0·85	0·91	0·77	0·71	0·66
Argentina	0·52	0·34	0·46	0·59	0·80	0·62	1·74
Italy	0·04	0·04	0·01	—	0·03	0·01	—
Other Foreign Countries	—	—	0·02	0·01	—	0·01	0·02
TOTAL FOREIGN COUNTRIES	89·81	88·14	87·68	81·50	80·57	82·93	86·79
Canada	2·91	3·40	4·89	7·38	4·09	5·82	7·19
Australia	5·39	6·04	5·21	7·79	10·45	6·70	2·02
New Zealand	1·86	2·38	2·18	3·29	4·85	4·52	3·98
British East Indies	0·02	0·03	0·03	0·02	0·03	0·02	0·02
Other British Possessions	0·01	0·01	0·01	0·02	0·01	—	—
TOTAL BRITISH POSSESSIONS	10·19	11·86	12·32	18·50	19·43	17·07	13·21
TOTAL	100·00	100·00	100·00	100·00	100·00	100·00	100·00

IV. AVERAGE VALUE PER HUNDREDWEIGHT OF QUANTITIES IMPORTED FROM EACH COUNTRY.

COUNTRIES.	1896.	1897.	1898.	1899.	1900.	1901.	1902.
	s. *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*	*s.* *d.*
Denmark	102 4	101 1	100 6	105 8	108 1	112 1	109 3
Russia	99 6	97 8	97 8	98 8	93 6	87 6	89 8
France	108 6	104 –	104 9	107 10	110 11	109 5	107 10
Holland	98 8	97 2	98 9	99 7	100 –	101 2	100 5
Sweden	102 10	101 4	101 10	101 6	103 5	104 2	103 11
United States	87 3	82 2	85 6	88 6	88 5	91 10	92 10
Belgium	99 11	99 7	95 9	91 6	93 3	97 9	99 1
Germany	99 6	101 8	103 10	101 –	105 11	111 4	110 3
Norway	96 4	98 –	100 1	99 5	100 9	107 10	106 –
Argentina	93 10	96 11	97 –	99 9	96 –	99 9	101 4
Italy	106 1	102 4	108 8	—	98 4	113 2	100 –
Other Foreign Countries	83 3	102 6	75 3	83 10	93 –	86 11	84 6
AVERAGE FOREIGN COUNTRIES	102 –	99 11	100 6	103 1	105 –	105 9	104 4
Canada	76 11	81 4	84 5	89 1	92 8	93 6	94 4
Australia	99 3	96 5	97 7	[illegible] 3	97 9	98 11	100 –
New Zealand	98 7	95 11	96 [illegible]	[illegible] 4	95 8	97 11	99 –
British East Indies	46 10	52 1	56 [illegible]	58 4	66 8	87 3	66 10
Other British Possessions	98 2	97 9	101 2	97 5	96 11	125 –	108 3
AVERAGE BRITISH POSSESSIONS	92 8	91 10	92 1	94 9	96 1	96 10	96 6
AVERAGE FOR ALL COUNTRIES	101 –	98 11	99 6	101 7	103 4	104 3	103 3

APPENDIX XXXIV.

Appendix XXXIV.

Report on a Proposed International Conference.

By Mr. A. E. **Balleine**, Secretary to the Committee.

To the Right Hon. Horace Plunkett, Chairman of the Departmental Committee on Butter Regulations.

Sir,—In accordance with your instructions I attended a Dairy Congress, which was held at Brussels on the 27th and 28th ult., and I beg to submit the following report of the proceedings so far as they relate to the inquiry now before the Butter Regulations Committee.

The Congress was organised by the National Dairy Society of Belgium, and it was of a semi-official character, inasmuch as a large number of the members who attended were representatives of various chemical and agricultural institutions of the Belgian Government and municipalities. The Belgian Minister of Agriculture, moreover, presided at the first meeting, and he stated that the decisions arrived at would carry great weight officially. The foreign delegates present included M. Roger, of the Institut Pasteur; M. Klein, the Director of the Agricultural Department of the Duchy of Luxemburg; M. Shei, representative of the Government of the Netherlands; and myself.

I give a short *resumé* of resolutions passed by the Congress, and omit several which were merely of local interest:—

(1) The obligatory pasteurisation of cream at 90°C. in all dairies where milk is received from several farms.

(2) The duty of all Belgian dairies:

- (a) To pasteurise their by-products at 90°C.;
- (b) To burn, or destroy by chemical means, the refuse from milk-separators;
- (c) To disinfect milk-cans each day with boiling water.

(3) The insertion of a clause in Belgian treaties with foreign Governments giving Belgium the right (1) to impose increased duties on dairy products from countries which refuse to take means to ear-mark adulterated exports; or (2) to apply special measures of inspection at the frontier or port of entry.

The special object of my attendance at the Congress relates to a proposed international agreement to prevent the adulteration of butter, and I think that my report will be simplified by considering the subject from the point of view of the existing Belgian law. (*See Enclosure.*)

A Royal decree, published on the 31st October, 1900, contained regulations for carrying the law into effect as from the 1st January, 1901, and certain "standards" were also fixed:

Article I.—Margarine intended for sale must be mixed, in course of churning, with at least 50 parts of sesame oil, and at least one part of dehydrated potato starch for every 1,000 parts of fats and oils employed in its manufacture.

Article III.—"Abnormal butter," of which the sale is prohibited, is butter which—although it may not be possible with certainty to declare it as adulterated, spoiled, or rancid—presents at least two of the following characteristics:—

- (a) A refractive index (Abbe-Zeiss) above 46° at 40°C.;
- (b) A critical temperature above 59°C. of solubility in alcohol "at 99°, 1 G.L.";
- (c) A density less than 0·864 at 100°C.;
- (d) A volatile fatty acid number (Meissl value) below 25;
- (e) A percentage of fixed fatty acids (Hehner value) greater than 89·5 per cent.;
- (f) A saponification number (Koettstorfer value) below 221.

Article V.—Butter containing more than 18 per cent. of substances (water, lactose, caseine) other than butter fat, colouring matter, and salt, cannot be exposed for sale . . . unless it is clearly labelled as "milky butter" (beurre laiteux).

It was in connection with the general subject of the sale of butter and margarine in Belgium that the question of an international "entente cordiale" was submitted to the Congress by M. Wauters, a Belgian Doctor of Science, who is chemist to the city of Brussels and Secretary to the Association of Belgian Chemists. He first discussed the subject of adulteration from the chemist's point of view—the difficulty caused by the variable nature of genuine butter, and the want of a characteristic test for the detection of oleo-margarine. He then referred to certain weak points in the existing law which have led to a good deal of litigation, *e.g.*, the sentence, "substances *analogous* to butter"; and the words "abnormal butter."

M. Wauters laid particular stress on his belief that the stringent regulations (relating to the ear-marking of margarine, etc.) protected the Belgian dairy industry from within, but tended to encourage the importation of adulterated butter from foreign countries. The Belgian manufacturer, for instance, is compelled to add potato starch and sesame oil to his margarine, and Belgian butter is subject to certain chemical standards. These measures no doubt also prevent the introduction of much abnormal and *heavily* adulterated butter from abroad, but then—and this is the important point—foreign margarine, unless it be of German origin, is not earmarked, and M. Wauters contends that foreign adulterators are able to add considerable quantities of margarine to butter from certain districts and during the favourable months of the year, and to glut the Belgian market with adulterated butter, which cannot be detected and stopped at the frontier because the foreign margarine which it contains has not been earmarked, and the product has been carefully manipulated so as to give a Reichert-Meissl value just above the required limit of 25. A large quantity of butter of this nature, *i.e.*, just above the required limits, does, as a matter of fact, pass through the Belgian Customs, and M. Wauters thinks that it is only reasonable to suppose that some is intentionally adulterated. In other words, whilst it is an easy matter to prevent the importaion of genuine margarine, although it has not been "denaturised," it is impossible to stop the entry of butter declared as genuine which may contain a comparatively large proportion of margarine which has not been earmarked before its incorporation into the butter.

This point was, indeed, brought before the Chamber of Representatives during the discussion on the Belgian Margarine Bill, and in connection with the German Law of the 15th June, 1897, which prescribed the addition to margarine of 10 per cent. of sesame oil. It was shown that the importation of Dutch butter into Germany in 1897, *i.e.*, before the German law came into force, amounted to 2,205,000 kilos., whilst in the following year, when the law was in force, the amount was 3,491,000 kilos. The deputy who quoted these statistics said that the large increase might have been due to economic causes, but he feared that it was the result of the law itself, which tended to favour the foreign adulterator. He warned the assembly that unless the Bill was strengthened the same conditions might obtain in Belgium, and that the measure, instead of benefiting the dairy industry, would injure the manufacturer of margarine as well as butter merchants.

It seemed to be generally admitted at the Congress that the existing Belgian law is not perfect, but the members were unanimously of opinion that the only remedy against the introduction of adulterated butter into Belgium, or, indeed, into any country, is by means of some international agreement on the subject. An attempt in this direction was actually made by the Belgian Government in 1900. France and Holland were approached without success through the ordinary diplomatic channels, but the President of the Congress—Baron Peers—announced that he had good reason to believe that France and Germany would now be willing to consider the matter favourably.

The Congress therefore unanimously passed a resolution calling on the Belgian Government to submit to the Governments of the various foreign countries interested in the butter industry a proposal to appoint an International Conference with a view to adopt some common basis of legislation as a means to prevent the exportation of adulterated butter. Baron Peers stated that foreign Governments would doubtless carefully consider such a proposal, especially as it was made for the common good by a neutral State which had recently played a not unimportant part in the more complicated question of sugar bounties. I was informed unofficially that the proposal would be put forward without delay.

An important statement was made to the Congress by M. Graftiau, the Director of the Government Laboratory at Louvain, who had received official permission to announce that one of his assistants has recently discovered a method which will probably settle the difficulty connected with the analysis of adulterated butter. M. Graftiau said that he firmly believed that the Gordian knot has been cut, but he could give no particulars, partly because the method was being tested under various conditions in order to corroborate the results already obtained, and principally because very valuable prizes have been offered in various quarters to the discoverer of a method of this character, and it was manifestly unadvisable to give the details at this stage. M. Andre, the Inspector-General of Agriculture, announced that the Government had given facilities for continuing the investigation without delay at the National Dairy School. I was informed that the date of a definite announcement on the subject could not yet be given.

I may mention that a difficulty has arisen in Belgium in connection with the denaturation of margarine, owing to the extensive use of butter ferments which contain potato starch, and the advisability of discovering some other culture medium was submitted to the Congress. For analogous reasons, the use of colouring matters which contain sesame oil was condemned.

The Congress finally decided to form an International Dairy Society, and to publish periodical bulletins, with a view to encourage dairy research, and to benefit the dairy industry throughout the world.

I have the honour to be, sir,
Your obedient servant,
(Signed) A. E. BALLEINE,
Secretary.

4, Whitehall Place, S.W., 10th May, 1902.

[Enclosure.]

BELGIAN MARGARINE LAW.

The following are the principal provisions of the law of 4th May, 1900, to regulate the sale of margarine in Belgium:—

The term butter is reserved for fat obtained from milk or cream by churning, with or without the addition of ferments, colouring matters, or salt. Other alimentary fats resembling butter in their external characters, such as appearance, consistency, colour, odour, taste, are termed margarine.

Mixtures of butter and margarine for sale are prohibited. Margarine for sale may not contain more than 10 per cent. of fat derived from milk. It must be mixed with substances which, while being inoffensive, and incapable of altering its organoleptic characters, will facilitate its distinction from butter. Particulars of these substances will be given later in a Royal decree.

Produce destined for direct export is exempted from these provisions if declared prior to manufacture.

Margarine must be delivered from a manufactory or wholesale dealer in vessels bearing the word "margarine" on every side, in letters at least four-fifths of an inch high, with the name and address of the firm.

Butter and margarine may not be sold on the same premises, and butter merchants or producers may not keep margarine, even for their personal consumption, on premises where butter is sold.

All shops where margarine is sold, as well as vehicles serving for peddling margarine, must bear the words "Sale of Margarine" in distinct type at least eight inches high, and clear of all other inscriptions. In market places margarine may only be sold at spots specifically indicated by the communal authority, and at least twenty-five yards from any butter stall.

All vessels or wrappers in which margarine is sold must have the word "margarine" in letters distinctly visible to the public, at least four-fifths of an inch high, and clear of all other matter, as well as the name and address of the seller. If sold in blocks, these must be cubical in shape and marked in a similar manner.

Abnormal butter may not be sold, *i.e.*, butter of which the characteristics differ from those of pure butter, although it does not clearly exhibit adulteration or serious alteration. A Royal decree will specify the physical and chemical indications by which these characteristics may be recognised.

COPY OF CORRESPONDENCE WITH THE FOREIGN OFFICE REGARDING THE PROPOSED CONFERENCE.

4, Whitehall Place, S.W., 9th September, 1902.

Sir,—I am directed by the Chairman of the Butter Regulations Committee to state for the information of the Secretary of State, that a "Dairy Congress" was held at Brussels on the 27th and 28th April last, and it was decided to invite the Belgian Government to summon an International Conference to consider means for repressing the adulteration of butter. I enclose a copy of a report on the subject.

I am requested to say that the Chairman would be very grateful if it could be ascertained whether the Belgian Government propose to take any action in the matter. The information would be of great value to the Butter Regulations Committee which will hold its final sittings early next month.

I am to add that Mr. Plunkett would also be glad to receive any information regarding the new method of butter analysis, to which reference is made in the enclosure to this letter.—I am, etc.,

(Signed) A. E. BALLEINE, Secretary.

The Under-Secretary of State, Foreign Office.

Foreign Office, September 15th, 1902.

Sir,—With reference to your letter of the 9th instant, I am directed by the Marquess of Lansdowne to transmit to you a copy of a despatch to His Majesty's Charge d'Affaires at Brussels, requesting him to ascertain whether the Belgian Government propose to take any steps with regard to the summoning of an International Conference, and instructing him to furnish a report on the new system of analysing butter.—I am, etc.,

(Signed) F. A. CAMPBELL.

The Secretary to the Butter Regulations Committee.

[Enclosure.]

Foreign Office, September 15th, 1902

Sir,—I transmit herewith for your information a copy of a letter from the Butter Regulations Committee, and of an extract from the report mentioned, and I request that you will endeavour to ascertain whether the Belgian Government propose to take any action in the matter, and that you will furnish me with a report on the new

Appendix XXXIV.

method of analysing butter referred to.—I am, etc. (for the Marquess of Lansdowne),

(Signed) F. A. CAMPBELL.

H. D. Harford, Esq.

The Under-Secretary of State for Foreign Affairs presents his compliments to the Secretary to the Butter Regulations Committee, and with reference to the letter from the Committee of the 9th ult., transmits herewith, by direction of the Marquess of Lansdowne, a copy of a note from the Belgian Government respecting a proposed International Conference relating to the adulteration of butter, and a new method of butter analysis in Belgium.

Foreign Office, October 14th, 1902.

[Enclosures.]

Brussels, October 14th, 1902.

My Lord,—In accordance with the instructions contained in your Lordship's despatch, No. 72, of this series of the 15th ultimo, I addressed a Note to the Belgian Government on the 16th ultimo, enquiring as to their intentions in regard to a proposed International Conference to consider means for repressing the adulteration of butter; and I also requested that I might be furnished with any available information concerning the reported discovery of a new method of butter analysis.

I have now the honour to transmit to your Lordship herewith copy of a reply which I have received to my communication, stating that the Belgian Government approached the Governments of France and Holland in 1899, with a view to taking common action for the repression of the adulteration of butter, but that, so far, no understanding has been reached on the subject.

I am also informed that the experiments which are taking place in butter analysis in the Louvain Laboratory have not, as yet, led to a reliable result.—I have, etc.,

(Signed) CONSTANTINE PHIPPS.

To Marquess of Lansdowne, K.G., etc., etc., etc.

Copy of the Reply of the Belgian Government.

Le Departement des Affaires Etrangères a l'honneur de faire savoir à la Legation de Sa Majesté Britannique, en reponse à sa Note du 16 Septembre dernier, que les Gouvernements Français et Néerlandais ont été pressentis en 1899 par le Gouvernement du roi au sujet des mesures qui pourraient être prises de commun accord pour enrayer la falsification des beurres, mais que des réponses reçues, le Gouvernement du Roi a dû deduire que pareille entente serait, quant à present au moins, difficilement realisable.

Monsieur le Ministre de l'Agriculture serait tout disposé néanmoins à profiter des circonstances favorables qui se produiraient pour renouveler ses démarches auprés des Gouvernements précités.

Monsieur le Baron van der Bruggen ajoute que la méthode d'analyse des beurres experimentee au Laboratoire de l'Etat à Louvain, fait toujours l'objet d'études et de recherches; mais les résultats obtenus jusqu' ici ne permettent pas de déclarer avec certitude qu'un procédé efficace de recherche des graisses etrangeres dans le beurre a été trouvé.

Bruxelles, le 13 Octobre, 1902.

(*Translation.*)

The Belgian Department for Foreign Affairs has the honour to inform H.B.M.'s Legation . . . . . that, in the year 1899, the Governments of France and of the Netherlands were approached by the Belgian Government regarding the possibility of taking measures in common with a view to prevent the adulteration of butter, but that the replies received indicated that an entente on the subject would be difficult to establish, at any rate at present. H.E. the Belgian Minister of Agriculture is, however, quite prepared to take advantage of favourable circumstances which may take place, and to renew the proposal to the above-mentioned Governments.

The Minister adds that the method of butter analysis at the State Laboratory at Louvain, is still under trial, but the results obtained do not yet indicate with certainty that the method affords a reliable means of detecting the presence of foreign fat in butter.

Brussels, 13th October, 1902.

APPENDIX XXXV.

MARGARINE LAWS IN VARIOUS COUNTRIES.

[See also *Index, Part II., Margarine Legislation.*]

I. AUSTRIA-HUNGARY.

(*Translation.**)

LAW OF THE 25TH OCTOBER, 1901, RESPECTING THE TRADE IN BUTTER, CHEESE, BUTTER-FAT, LARD, AND THEIR SUBSTITUTES.

Section 1. Margarine, margarine fat or margarine cheese in the meaning of this law are those products similar to milk-butter, butter-fat or cheese, the fatty contents of which do not come exclusively from milk.

Oleomargarine (margarine) in the meaning of this law is that fatty product which is obtained by melting down raw tallow and eliminating the firm stearine portions. Artificial food fat in the meaning of this law are those products similar to lard the fatty contents of which do not consist exclusively of lard.

Unadulterated fats of particular kinds of animals and plants are not to be regarded as artificial food fats.

Section 2. The products enunciated in Section 1 are only allowed to be put on the market with the specification which corresponds to their real character.

Section 3. It is prohibited to put on the market for home consumption:—

(*a*) Mixtures of butter or butter-fat with oleomargarine, margarine, margarine fat or other food fats. The employment of milk or cream in the industrial production of margarine or margarine fat is permissible, provided that not more than 100 parts by weight of milk, or a corresponding quantity of cream, are used to 100 parts by weight of the fats which do not come from milk.

(*b*) Margarine, margarine fat, oleomargarine or margarine cheese, the manufacture of which does not conform to the prescriptions of Section 4.

Section 4. In order to facilitate the recognition of margarine, margarine fat, oleomargarine and margarine cheese, which are intended for home trade, a suitable admixture which does not injure the colour and other properties of the same is to be added to these products in their manufacture. Oleomargarine which is intended for further working-up in home margarine factories is not subject to this regulation. More precise specifications will be issued by decree (*see pp.* 642-3).

Section 5. Every person wishing to manufacture for the purpose of trade oleomargarine, margarine, margarine cheese or artificial food fat must, concurrently with the prescribed application for approval of the plant, notify to the industrial authorities the premises designed for the manufacture, storage, packing and sale of the goods. For factories already in existence due notice is to be given within four weeks after this law comes into force. Any change of the premises or persons amenable to notification must be notified to the industrial authorities within three days. Oleomargarine, margarine, margarine fat, margarine cheese and artificial food fat are not to be hawked about.

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* *Supplied by the Foreign Office.*

Section 6. The heads of firms engaged in the manufacture of oleomargarine, margarine, margarine fat, margarine cheese or artificial food fat, together with their managers and foremen are bound on demand to give information to the inspecting functionaries (Section 13) as to the process of manufacture, the extent of the business and the raw material employed. The inspecting functionaries are bound, except when making their official reports or notifying infringements of the law, to preserve silence as to facts and methods coming to their knowledge in the exercise of their control.

Section 7. In premises where butter or butter-fat is manufactured, stored, or packed for sale, the manufacture, storage, packing or sale of oleomargarine, margarine, margarine fat, or artificial food fat is prohibited. In like manner in premises where cheese is manufactured, stored, packed or offered for sale, the manufacture, storage, packing or sale of margarine cheese is prohibited. An exception to this regulation is the storage and keeping on sale of the necessary quantities for retail trade in public places of sale, as well as the packing of goods there sold retail. But oleomargarine, margarine, margarine fat, margarine cheese and artificial food fat must be kept in special receptacles and in special portions of the salerooms, apart from the space devoted to the storage of butter, butter-fat or cheese.

Section 8. On premises and other places of sale, including market stands, where margarine, margarine fat, oleomargarine, margarine cheese, or artificial food fat is sold, a legible ineffaceable notice must be posted up where it catches the eye.—"Margarine," "margarine fat," "oleomargarine," "margarine cheese," or "artificial food fat."

Section 9. Oleomargarine, margarine, margarine fat and artificial food fat are to be put on the home market in receptacles (case, tub, barrel, box, &c.) marked by a prominently-coloured stripe upon which the name of the manufacturer and the specification of the contents are stated in clear and ineffaceable characters. The receptacles filled with the goods mentioned must, if their weight exceeds 3 kilos, be provided with an officially-registered lead, before they are put on the market. In the retail trade, margarine and margarine cheese must be sold in a paper wrapper provided with specific coloured lines. Precise regulations dealing with the trade, wholesale and retail in the manufactures specified in Sect. I. and with the colour of the wrappers, will be issued by decree.

Section 10. In public notifications, sales-notes, accounts, bills of lading, and other documents employed in commercial intercourse, and referring to the delivery of oleomargarine, margarine, margarine fat, margarine cheese, or artificial food fat, only those specifications (*Warenbezeichnungen*) may be employed which are in conformity with this law, and the orders issued in virtue of the same.

Section 11. Manufacturers of oleomargarine, margarine, margarine fat or margarine cheese, who manufacture goods designed for export or working-up in home margarine factories which deviate from the provisions contained in Sections 3 and 4, paragraph 1, must by Section 5 notify this in writing to the industrial authorities. Oleomargarine, margarine, margarine fat or margarine cheese, which are manufactured for export or working-up in home margarine factories, must, up to the moment of despatch, be kept in their own store-rooms apart from the other store-rooms. Proofs as to an order for goods and their despatch respectively must be furnished by production of the order in question, the books, &c., upon demand of the inspecting functionaries mentioned in Section 13 and their co-ordinates. Factories in which oleomargarine, margarine, or margarine fat, are manufactured, deviating from the regulations contained in Sections 3 and 4, paragraph 1, must not keep on sale or sell butter or butter-fat.

Section 12. The foregoing regulations are not applicable to products of the kind specified in Section 1, which are not intended for human consumption.

Section 13. The inspecting functionaries and their co-ordinates specified in Section 2 of the law of 16th January, 1896, respecting the trade in articles of consumption and certain articles of daily use, are authorised to enter those premises in which butter, butter-fat, cheese, oleomargarine, margarine, margarine fat, margarine cheese, or artificial food fat is manufactured, stored, packed, or kept for sale, to pass revisions therein and take samples. The procedure to be followed is the same as prescribed by the law of 16th January, 1896.

Section 14. The Government is authorised to prohibit the industrial sale of butter, the fatty contents of which do not reach a specified limit, or which contain water or salt in excess of a specified limit.

Section 15. An offence is committed:

1. by any person who, contrary to the regulations of Section 13, refuses admission to the premises, or to allow a sample to be taken or a revision to be passed;
2. by any person who, contrary to the prescriptions of Section 6, refuses the information demanded, or who wittingly gives false information.

The penalty is one to fourteen days' arrest, or 10 to 200 kronen (about 8s. to £8); in the event of a repetition of the offence within three years of the purging of the same: from three days to three weeks' arrest, to which may be added a fine of 50 to 500 kronen (about two guineas to 20 guineas).

Section 16. An offence is committed by any person who, with a view to deception in commerce and trade:

(1.) manufactures one of the mixtures inadmissible by Section 3, par. 1;

(2) sells, keeps on sale, or puts on the market such mixtures;

(3) manufactures, sells, keeps on sale, or puts on the market oleomargarine, margarine, margarine fat, or margarine cheese, without the admixture required by Section 4;

(4) sells, keeps on sale, or puts on the market under a false specification, the articles of consumption enumerated in Section 1;

(5) sells, keeps on sale, or puts on the market, contrary to the prescriptions of Section 9, oleomargarine, margarine, margarine fat, and artificial food fat, without the distinguishing marks or leads therein prescribed.

The penalty is one week to three months' arrest, to which may be added a fine up to 1,000 kronen (=40 guineas), or in money 10 to 1,000 kronen (=8s. to 40 guineas). At the same time, a public notification of the sentence may be ordered in the official gazette, and one other public journal.

If this offence is repeated within three years, the penalty is one week to three months' arrest, to which a fine of 10 to 1,000 kronen (8s. to 40 guineas) may be added.

At the same time, a public notification of the sentence is to be ordered in the official gazette, and in one other public journal.

Section 17. An offence is committed by any person who acts in contravention of the enactments of this law, or of the decrees issued by the Government in virtue of Sections 4, 9, and 14.

The penalty is three days to three months' arrest, with which may be coupled a fine up to 1,000 kronen (=40 guineas); or a fine of 10 to 1,000 kronen (=8s. to 40 guineas).

Section 18. The penal enactments of Sections 15 to 17 inclusively of this law, are only applicable if the offence does not prove the existence of an offence worthy of severer punishment.

Appendix XXXV.

The penal enactments of Sections 9, 10, and 11 of the law of the 16th January, 1896, respecting the trade in articles of consumption and certain articles of common use, are only applicable to offences which fall under the penal enactments of Sections 15 to 17of the present law, if these offences were committed before the coming into effect of the present law.

The mode of procedure and the passing of sentence in offences provided for in the present law, is vested in the district courts.

Section 19. This law comes into force three months after the day of proclamation.

Section 20. With the execution of this law, my Minister of the Interior, my Minister of Justice, my Minister of Commerce, and my Minister of Agriculture are entrusted.

(Signed) **Franz Joseph.**
Spens.
Giovanelly.
Koerber.
Call.

Vienna, 25th of October, 1901.

Regulations.

A.

Order of the Ministries of the Interior, Justice, Commerce and Agriculture of 1st February, 1902, whereby executory regulations are issued for the law of 25th October, 1901, respecting the trade in butter, cheese, butter-fat, lard, and their substitutes.

By virtue of the law of 25th October, 1901, respecting the trade in butter, cheese, butter-fat, lard and their substitutes, it is decreed as follows:

Art. I. (to Section 4 of the Law).

Sesame oil is to be added to the fats and oils employed in the manufacture of margarine, margarine fat, oleomargarine, and margarine cheese, which are designed for the home market.

This addition must, for every 100 parts by weight of the fats and oils used for margarine and margarine fat, as well as oleomargarine, amount to at least ten parts by weight in the case of oleomargarine, and at least five parts by weight in the case of margarine cheese.

The sesame oil is to be added during the mixing or melting down of the fats. The sesame oil which is about to be added must show the following reaction:

If a mixture of 0·5 c.c. of sesame oil and 99·5 c.c. of cotton-seed oil or earth-nut oil be shaken up with 100 c.c. of fuming hydrochloric acid of specific gravity 1·19, and a few drops of a 2 per cent. alcoholic solution of furfurol, the hydrochloric acid settling under the layer of oil must assume a distinct red or bluish red hue. The furfurol which serves as reagent must be colourless; at most it may be coloured yellow.

Oleomargarine which is designed for working-up in home margarine factories, and hence in the meaning of Section 4, Par. 2, of the law of 25th October, 1901, is not to receive an addition of sesame oil, must not be coloured.

Art. II. (to Sections 5, 8, and 11 of the Law).

The premises designed for the manufacture, storage and packing of oleomargarine, margarine, margarine fat, margarine cheese, and artificial food fat must contain a notice, legible and ineffaceable, and hung where it catches the eye, from which may be gathered the use to which the premises in question are put.

The business and other places of sale, inclusive of market stands, in which the manufactured products enumerated in the first paragraph are kept on sale, must contain the notice prescribed in Section 8 of the law of 25th October, 1901.

The store-rooms in which oleomargarine, margarine, margarine fat, margarine cheese which have been manufactured for export or working-up in home margarine factories are kept, must be provided with a notice indicating the destination of the goods in the manner prescribed in the first paragraph.

Art. III. (to Section 9 of the Law.)

With regard to the exterior marking of oleomargarine, margarine, margarine fat, margarine cheese and artificial food fat, the following regulations are to be observed:—

The receptacles in which oleomargarine, margarine, margarine fat, or artificial food fat are put on the home market must be painted with an ineffaceable red stripe, upon which the manufacturer's firm and the description of the contents are marked in plain ineffaceable letters.

The red stripe is to be painted parallel to the surface of the bottom of the receptacles and at least 3 centimeters (1¼ inches) from the top border, and must encircle without a break the whole receptacle.

The stripe must not be placed on the hoops or bands encircling the receptacle.

The red stripe must be at least 10 centimeters (= 4 inches), in height and the letters designed for the description of the contents (oleomargarine, margarine, margarine fat, or margarine food fat) must be at least 3 centimeters (1¼ inches) in height.

The length of the word describing the contents must be at least eight times, and not more than twelve times, the height of the letters.

The height of the red stripe, the height of the letters, and the length of the describing word, may in the case of round or oval receptacles (barrel, box, tub, etc.), in which the greatest diameter of the lid measures less than 40 centimeters (= 16 inches) but more than 10 centimeters (=4 inches), be modified by half.

The same is the case with angular receptacles, of which the longest side of the cover is less than 40 centimeters (= 16 inches) but more than 10 centimeters (= 4 inches). In the case of receptacles with the above specified form, the cover of which has a maximum diameter or maximum side of 10 centimeters or less, the height of the stripe and the letters as well as the length of the word describing the contents may be diminished by one-third of the prescribed measure.

The manufacturer's firm may be put below or beside the description of the contents. In the former case, however, a space at least one centimeter (⅜ inch) broad must be left free between the description of the contents and the firm; in the latter case a six-pointed full star with a diameter of at least half the height of the letters used to describe the contents must be placed between the description of the contents and the firm in fast black colour.

The above-mentioned notices must not extend over the edge of the red stripe; they are to be affixed at least twice, and in such a manner as to be on two opposite sides of the receptacle.

If the receptacle has a cover, the notices are also to be legibly written on the top, and, in the case of barrels, on both top and bottom. Hence the inscriptions are to be written there in legible, ineffaceable, black letters, though no red stripes be on the top and the bottom of the receptacle.

On the receptacles, but not within the red stripe, may also be written the trade mark, the goods or factory mark of the manufacturer, as well as the name, trade mark, goods mark of the vendor. But no specifications may be used for this purpose of a nature to deceive as to the contents of the receptacles or the character of the goods, *e.g.*, "sweet cream margarine."

The registered leads affixed to full receptacles of more than 3 kilos weight must be at least 1 centimeter in diameter, and be easily recognisable.

The paper wrappers to be used in the retailing of margarine and margarine cheese must be provided with a straight red stripe in the middle, at least 2 centimeters broad, joining without a break the two borders farthest distant from each other.

The retailing of oleomargarine, margarine fat and artificial food fat may only be done either immediately from the original receptacles put by the manufacturer on the market, or from stock-receptacles; but the latter must be duly marked conformably to the prescriptions required.

If margarine or margarine cheese is sold or kept on sale, wholesale or retail in regular quantities, these must be in the shape of cubes, which must moreover have the word "margarine" or "margarine cheese" stamped on them.

Art. IV. (to Section 11 of the Law.)

With respect to the amount manufactured, the stock and delivery of oleomargarine, margarine, margarine fat, and margarine cheese, manufactured for export or further working-up in home factories, special registers are to be kept by the manufacturers, which the inspecting functionaries are to be allowed to consult.

Art. V.

With respect to those manufactured products similar to milk-butter or butter-fat or lard, which are manufactured without the use of milk-fat or lard respectively: furthermore, with respect to those fatty ingredients similar to oleomargarine which are manufactured with one another or with fat oils by the mixing of animal or vegetable, firm or half-soft fats (*e.g.*, tallow *premier jus*, oleomargarine, cotton stearine, and the like), the prescriptions of the law of October 25th, 1901, R.G.B., No. 26, and of this decree have their due application.

Unadulterated fats of particular kinds of animals and plants may only be put on the market with a specification which is in conformity with their real character.

Art. VI.

This decree comes into force three months from the day of publication.

(Signed.) KOERBER. (Signed.) SPENS.
,, CALL. ,, GIOVANELLI.

B.

Order of the Ministry of Commerce in accord with the Ministries of the Interior, Justice, and Agriculture of June 5th, 1902, whereby regulations are issued respecting the official registration of leads in the meaning of Section 9, par. 2, of the law of October 25th, 1901, dealing with the trade in butter, cheese, butter-fat, lard, and their substitutes.

In virtue of Section 20 of the law of October 25th, 1901, dealing with the trade in butter, cheese, butter-fat, lard, and their substitutes, and for the carrying into effect of the provision of Section 9, par. 2, of the law, whereby receptacles containing oleomargarine, margarine, margarine fat and artificial food fat, exceeding 3 kilograms in weight, must, before they are put upon the home market, be provided with an officially-registered lead; it is ordered as follows:—

Section 1. For the purpose of the official registration of these leads a list is kept at the Ministry of Commerce with a collection of the leads entered upon the list.

Section 2. Every producer of oleomargarine, margarine, margarine-fat, and artificial food-fat must choose one lead for his entire business and declare the same in writing at the Ministry of Commerce for official registration.

Section 3. The declaration must contain:—

1. The Christian and surname or the producer's firm, as the case may be;
2. The business address and exact description of the business.

The declarant must subjoin to the declaration, which is to be signed by him, three specimens of the lead, each in a separate cover, and corresponding in every particular with the description in the declaration.

Section 4. The entry of the leads recognised as admissible by the Ministry of Commerce upon the list is made in order of date of receipt of the prescribed written notification at the Ministry of Commerce.

Upon due registration of the lead, the declarant will receive a certificate together with the return of one specimen of the lead.

Section 5. The Ministry of Commerce examines every lead declared as to its fitness for being registered for the object in view, especially as to its being distinguishable from leads already registered; and exercises its own judgment as to the admissibility of the same.

Section 6. The registration of a lead on the list of the Ministry of Commerce conveys no exclusive rights to its use in the meaning of the law of January 6th, 1890, respecting the protection of marks, or of the law of June 30th, 1895. Marks, however which have been already registered according to the laws just quoted, may, in so far as they are adapted to being used on the leads which are the object of this order, be declared for official registration as leads in the meaning of the law of October 25th, 1901.

Section 7. The present order comes into force on the day of its promulgation.

(Signed.) KOERBER. (Signed.) SPENS.
,, CALL. ,, GIOVANELLI.

C.

HUNGARIAN REGULATIONS.

PRÉCIS OF THE ORDER OF THE ROYAL HUNGARIAN MINISTER OF AGRICULTURE REGARDING THE MANUFACTURE AND SALE OF ARTIFICIAL GREASE FOR EATING PURPOSES AND OF MARGARINE CHEESE.

Artificial grease for eating purposes is deemed to be any grease or mixture of grease which is similar to pig's grease, and is made for the same purpose, but is not exclusively made of pig's grease.

Artificial grease for eating purposes must be mixed with Dimethylaminoazobenzene in the proportion of 1 decigram to 100 kilograms before it is brought to market.

Artificial grease for eating purposes can only be sold in barrels marked with a red stripe 5 centimetres wide and bearing the inscription in type 10 centimetres high: "Artificial grease," and also the indication of the factory where it was made.

All places where the said article is sold must be conspicuously marked with the inscription: "Artificial grease for eating purposes sold here," in type at least 10 centimetres high.

All vessels in which artificial grease is sold must be marked with a red stripe and be conspicuously marked with the inscription: "Artificial grease."

Tradesmen who deal in artificial grease in quantities exceeding 25 kilograms must comply with the same rules as are prescribed for the manufacturers of this article.

Articles which contain no fatty substances derived from milk, or which in addition to such substances also contain some other sort of grease, for instance margarine, can only be sold under the name of "Margarine."

Margarine can only be sold if it has been mixed with Dimethylaminoazobenzene in the proportion of 3 milligrams to 1 kilogram.

Vessels and parcels in which margarine is kept or sold must bear the inscription: "Margarine cheese."

All places where margarine is manufactured or sold must bear in a conspicuous manner the inscription: "Margarine cheese factory," or "Sale of margarine cheese" in type at least 30 centimetres high.

Manufacturers or sellers of margarine are forbidden to sell or manufacture pure milk, or pure milk products, at the same place as they manufacture or sell margarine. Victuallers selling various sorts of provisions in public shops are exempted from this provision, but if they keep or sell margarine they must keep it in separate vessels bearing the inscription: "Margarine cheese."

II. BELGIUM.

Belgian Margarine Law, 1903

Appendix XXXV.

(*Translation.*)

Section 1. The term butter is reserved for fat obtained from milk or cream by churning, with or without the addition of ferments, colouring matters, or salt.

Section 2. Other alimentary substances resembling butter in their external characters are termed margarine. Alimentary fats include fatty substances, intermixed, or with oils or water; and fats, with the exception of lard, prepared otherwise than by processes necessary for their extraction and refining. By-products of the pork and meat trades, which are merely melted and exposed for sale in the vessels wherein they have been prepared, are also excepted.

Section 3. Mixtures of margarine or alimentary fats prepared for commercial purposes are prohibited. Margarine may nevertheless contain up to 10 per cent. of fat derived from milk.

Section 4. In the preparation or preservation of commercial butter it is forbidden to employ ferments, colouring matter, vessels, or other utensils containing or having contained, substances which must be added (*see* § 5) to margarine and other alimentary fats; or utensils which have been in contact with the substances in question.

Section 5. Margarine and alimentary fats intended for sale, and in order to distinguish them easily from butter, must be mixed with certain substances which are harmless and do not affect the organoleptic character of the margarine, etc. The selection of these substances, and the official regulations for their use, are fixed by official Regulations (*q.v.*).

Margarine factory products intended for export to countries where analogous legislation does not exist as regards ear-marking margarine are exempted from this regulation, provided a declaration be made before the manufacture of such products.

The Belgian Government can order the similar ear-marking of any foreign fat which may hereafter be employed to adulterate butter.

Section 6. Margarine or alimentary fats from factories or wholesale *dépôts* must be despatched in receptacles of which the material, shape, dimensions, and marks are fixed by regulation. Each side of such receptacles must bear the inscription, "Margarine" or "Alimentary Fat" in distinct letters (at least two centimetres in height), together with the name or designation, and address, of the manufacturer or merchant.

Section 7. The sale of butter, margarine, and alimentary fats on the same premises is forbidden, or on premises intercommunicating, except by means of the public highway. Merchants, producers, or distributors of butter are forforbidden, even for their own personal use, to keep margarine or other alimentary fats, or to allow other persons to do so, on premises where butter is sold, or stored for sale or delivery; or to carry these substances at the same time as butter. Butter producers or blenders are forbidden to keep margarine, alimentary fats, or other fats intended for food, on premises where butter is made or prepared for sale. It is likewise forbidden to manufacture or keep butter which is intended for sale on premises where margarine or other alimentary fatty substances are made or stored.

Section 8. Premises where margarine or alimentary fats are sold, or stored or prepared for sale, and vehicles employed in the distribution of these substances, must bear the inscription, "Sale of Margarine," or "Sale of Alimentary Fat," in letters at least 20 centimetres in height, clear of any other inscription, and sufficiently distinct to be read from the public highway. Margarine and alimentary fats may be brought into a market only at special places selected by the local authority, and at a distance of at least 25 metres from the butter stalls.

Section 9. All receptacles or covering materials in which butter or alimentary fats are sold, or stored for sale or delivery, must bear the inscription, "Margarine" or "Alimentary Fat," in clear letters at least two centimetres in height, separate from any other lettering, with the name or designation of the maker or seller. If the margarine or alimentary fats be in lumps, their shape must be cubical, and the cubes must be legibly stamped with the words, "Margarine" or "Alimentary Fat," as well as with the name or designation of the maker or seller, unless the covering material contains this information.

Section 10. Margarine and alimentary fats must be retailed in receptacles or covering material marked with the name and address of the seller, in addition to the words "Margarine" or "Alimentary Fat," in distinct letters at least two centimetres in height.

Section 11. It is forbidden to prepare for sale, transport, sell, retail, place on sale, or store for sale or for delivery in warehouses, shops, stalls, etc.:—(*a*) Margarine or alimentary fats mentioned in the first and second paragraphs of § 2 which do not satisfy the conditions of § 5. (*b*) Any mixture of butter and margarine other than the mixture permitted by § 3. (*c*) Butters which, although they may not directly indicate adulteration or serious alteration, are widely different from average pure butters in composition. The physical and chemical characteristics of pure butter are indicated in the Regulations (*q.v.*).

Section 12. Inspectors may at all times enter factories to see that this law is observed, and they may take samples at the ports, railway stations, warehouses, and shops, as well as from vehicles employed in the wholesale and retail trade. These officials are also authorised to take samples from goods taken out of bond, but a Customs officer must also be present, and notice must be given to the parties interested, or to their representatives.

Section 13. Any person who has knowingly prepared for sale, carried, sold, detained for sale or for delivery, articles included in § 11 (*a*) (*b*) shall be imprisoned from eight days to two months, and fined from 26 to 200 francs. One of these penalties only may be inflicted. This punishment may be doubled on repetition of the offence within two years of the previous sentence. The Court may likewise order that a full or partial report of the judgment be posted up in public places, or published in newspapers, selected by the Court, at the cost of the defendant.

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(Signed) Leopold.

August 12th, 1903.

Belgian "Butter and Margarine Regulations," 1903.

The trade in butter, margarine, and alimentary fats is subjected to the following Regulations, independently of Arts. 454 to 457, 498, 500 to 503, 561 (2) and (3), of the Penal Code dealing with foodstuffs mixed with substances injurious to public health; with spurious, adulterated, spoilt, or diseased food; of the Law of the 12th August, 1903; and of the Royal Decrees relating to colouring matters and to the utensils, etc., employed in the food trade:

Art. 1. (1) Margarine and alimentary fats intended for sale must during the operation of churning be intimately mixed with at least 50 parts of sesame-oil, and at least two parts of dry starch of commerce, previously diluted in oil to every 1,000 parts in weight of fats and oils employed. The sesame-oil may be added during the course of manufacture which precedes the operation of churning; and the starch must be added to the raw materials immediately after their introduction into the churn.

(2) The sesame-oil and starch intended for mixtures must be kept in receptacles labelled "Sesame-oil for mixtures," and "Starch," and placed in special places or in a part of the factory selected by the Excise authorities.

(3) Alimentary fats prepared without churning must receive the sesame-oil and the starch during the process of manufacture which gives them their legal character of alimentary fats.

Appendix XXXV

(4) The sesame-oil intended for mixtures must give the following reaction: a mixture of 0·5 parts by volume of sesame-oil and 99·5 parts of cotton-seed oil, or arachis oil, is stirred with 100 parts by volume of fuming hydrochloric acid (density 1·19) and a few drops of a 2 per cent. colourless alcoholic solution of furfurol. The acid solution which forms below the oily layer assumes a clear pink colour. The cotton oil or arachis oil must be previously tested to verify that it does not yield any sensible reaction with furfurol.

(5) Notwithstanding the terms of (1) and (4), the manufactured product must contain the minimum quantity of starch prescribed, and a mixture of 10 parts by volume of fat of the finished article with 90 parts of cotton-seed or arachis oil must itself give a clear pink colour by the test indicated above.

Art. 2. (1) In order to benefit from the exemption indicated in § 5 (2) of the Law of the 12th August, 1903 (*q.v.*), the maker must, before manufacture, enter on a register, to be submitted to the inspectors, the quantity of margarine or alimentary fats which he intends to make in exemption of the terms of § 5 (1), and the date of manufacture.

(2) During the various processes of manufacture (churning, blending, package, etc.), the product and the vessels and utensils in which it is placed must bear a card distinctly labelled "Export obligatory."

(3) The product must be packed in receptacles labelled, at any rate on the outer cover, and in addition to the word "Margarine," and the address of the maker, the words "Export obligatory," placed on the top side of the receptacle, and in accordance with the legal conditions required for the inscription, "Margarine."

(4) The packed product, as well as the finished but unpacked article, must be placed immediately in a special store, built of lathes if necessary, and the door must be provided with two locks, one key being retained by the maker and the other by the local Excise officer. The goods cannot be withdrawn except for immediate despatch to an export office for the purpose of packing; or for immediate rechurning.

(5) Before withdrawal from the special store entries must be made in the register indicating the amount withdrawn, the cause of withdrawal, the number of packages exported, the date of despatch and the name of the office of export. The packages for export must be duly stamped by the Excise authorities before withdrawal.

(6) The goods must be actually exported or returned to the factory within a fortnight of their withdrawal.

(7) If returned to the factory the goods must be immediately placed in the special store, and duly noted on the register.

Art. 3. (1) Margarine and alimentary fats from factories or wholesale stores, except goods exempted under Art. 2 must be despatched and delivered in receptacles bearing a bright red band from 5 to 10 centimetres broad.

(2) These receptacles must bear on each side the inscription "Margarine" or "Alimentary Fat" in clearly legible black letters on a white ground; the letters to be at least 2 centimetres in height and separate from any other words. If the surface be spherical the inscription must be repeated at least four times, so as to be seen in any position occupied by the receptacle.

(3) The receptacle must in addition bear the name or designation and the address of the maker or seller.

(4) The inscription "Margarine" or "Alimentary Fat" must be branded or marked with paint or Indian ink on the receptacle itself. In the case of baskets, it is permitted to attach to the wicker-work a galvanised iron label, securely fixed at each end with a wire of at least half a millimetre in thickness, the ends being twisted together internally.

(5) If the package has more than one cover, and the external one is made of paper or material which can be easily torn or withdrawn, the internal cover must also bear the prescribed marks.

Art. 4. For the application of § 11 (*c*) of the Belgian Margarine Law, 1903 (*q.v.*), butter shall be regarded as "abnormal," varying in composition from that of average pure butter, when it presents at least two of the following characteristics:—

(*a*) A refractive index (Abbe-Zeiss) above 46° at 40°C.;

(*b*) A critical temperature above 59°C. of solubility in alcohol at 99°. 1 G.L.;

(*c*) A density less than 0.864 at 100°C.;

(*d*) A volatile fatty acid number (Meissl value) below 25;

(*e*) A percentage of fixed fatty acids (Hehner value) greater than 89.5 per cent.;

(*f*) A saponification number (Koettstörfer value) below 221.

Art. 5. Every seller of margarine or of alimentary fats is forbidden to use the words "milk, butter, or cream," or derivatives of these words, on wrappers, in notices, signs, advertisements, or any commercial document, to indicate his trade or products. Illustrations or drawings showing any connection with the milk or butter industries are similarly forbidden. Invoices, delivery notes, and all commercial documents must indicate the goods as "margarine" or "alimentary fat." It is, however, permissible to employ the special name of each brand of margarine or alimentary fat.

Art. 6. Butter containing more than 18 per cent. of substances, other than butter-fat and salt, cannot be sold, delivered, placed on sale, stored, or despatched for sale or for delivery, unless it be labelled or placed in a cover marked very distinctly as "Butter mixed with water."

Art. 7. The following substances are declared deleterious under Art. 561 (2) of the Penal Code, as amended by Art. 5 of the Law of the 4th August, 1890:—(1) Butter, margarine, or alimentary fats manufactured from milk of which the sale is forbidden. (2) Butter, margarine, or alimentary fats, to which preservatives or glycerine have been added. It is forbidden to sell, retail, or place on sale these articles, or margarine or alimentary fats which have not been manufactured or imported in conformity with the meat-trade regulations.

Art. 8. Penalties for infraction of Art. 1, 2, 3, and 4 of these Regulations are punishable by the Law of the 12th August, 1903; and for infraction of Arts. 5, 6, and 7 by the Law of the 4th August, 1890, independently of the penalties provided by the Penal Code.

Art. 9. The Regulations of the 31st October, 1900, relating to the butter and margarine trades are rescinded.

Art. 10. These Regulations, and the Law of the 12th August, 1903, shall come into force on the 1st November, 1903.

(Signed) LEOPOLD.

October 20th, 1903.

BELGIAN "LARD REGULATIONS," 1903.

Art. 1. The term "lard" is limited to pure fat derived from pigs. Other alimentary fats (excepting butter, margarine, and the alimentary fats which are included in a separate Law and Regulations) must bear a designation which accurately describes their nature.

Appendix XXXV.

Art. 2. Every receptacle or wrapper wherein fatty substances other than lard, butter, margarine, and alimentary fats are exposed for sale, or stored for sale or delivery, must bear an inscription, visible to the public, in distinct characters, indicating the name or designation and the address or the trade mark of the maker or seller. This inscription must be placed on the receptacles or wrappers in which the goods in question are delivered to the purchasers, or despatched for sale or delivery.

Art. 3. The designation of the nature of the goods, as mentioned in Art. 1, must be repeated in the delivery notes and invoices.

Art. 4. Lard containing salt cannot be sold, exposed for sale, stored, or despatched for sale, unless it be labelled as "Salted."

Art. 5. It is absolutely forbidden to sell, expose for sale, store, or despatch for sale, lard or other alimentary fats which are: (*a*) mixed with mineral substances (other than water and salt), preservatives, or glycerine; (*b*) spoilt or diseased; (*c*) prepared or imported in contravention of the meat-trade regulations.

Art. 6. It is forbidden to sell, expose for sale, or store for sale or delivery, on the same premises, or on premises which adjoin, except by a public highway, as well as to despatch simultaneously in the same vehicle for sale or delivery, food stuffs and fatty substances which are not intended for food, but which have some analogy with alimentary fats, unless the receptacles containing these non-edible fatty substances are distinctly labelled so as to indicate that they are not intended for food.

Art. 7. The Regulations of the 27th December, 1896, are rescinded.

(Signed) LEOPOLD.

October 20th, 1903.

III. FRANCE.

FRENCH MARGARINE LAW, 1897.

(*Précis.*)

The French Law of the 16th April, 1897, relating to the repression of fraud in the butter trade and in the manufacture of margarine provides as follows:—

It is forbidden to designate, sell, expose for sale, import or export, under the name of butter (with or without qualifying words), any substance not made exclusively from milk or cream, with or without salt or colouring matter.

All alimentary substances other than butter, which present the appearance of butter and are prepared for the same purpose, can be described only as margarine, whatever their origin, source, and composition. Under no circumstances may colouring matter be added to margarine as thus defined.

Manufacturers, warehouse keepers, merchants, and retailers of butter are forbidden to manufacture, or to retain upon their premises or elsewhere, margarine or oleomargarine, or to allow other persons to manufacture or store it on premises occupied by them. Margarine and oleomargarine can only be brought on to the markets at places specially designated by the municipal authorities.

The quantity of butter contained in margarine for sale (whether by churning milk or cream with oleomargarine or by subsequent addition) must not exceed 10 per cent.

Persons desirous of carrying on the manufacture of margarine must notify the local authorities. Margarine factories, warehouses, and shops must bear a notice with the words margarine (or oleomargarine) factory (or warehouse or shop) in letters at least one foot high.

Margarine factories are subjected to the supervision of inspectors, appointed by the Government, but paid by the establishments at a salary to be fixed by the Council of State. These inspectors are required to supervise the entry and quality of the materials, the manufacture, and the despatch of the margarine. They are to see that all regulations prescribed by Government regarding sanitary matters are strictly observed, and they can prohibit the use of unsound materials or of such as are injurious to health. They can at all times enter any part of the premises.

All packages, boxes, cases, etc., containing margarine must bear the word "margarine" or "oleomargarine" in clear and indelible type. The constituent parts of the margarine must be shown on labels and in the invoices. In the wholesale business the packages must also show clearly the name and address of the manufacturer. When the margarine is intended for export, the manufacturer is authorised to substitute the trade mark of the purchaser for his own, conditionally upon this mark bearing the word margarine in clear and indelible characters.

In the retail trade, margarine or oleomargarine must be delivered in cubes with the word margarine (or oleomargarine) impressed upon one face, and put into a wrapper also bearing the same designation with the name and address of the seller. If these cubes are retailed, the goods must be delivered in a wrapper with the said inscription. This regulation applies also to margarine or oleomargarine imported, exported, or sent away. It is forbidden to sell margarine or oleomargarine except in such wrappers with the above-mentioned descriptions; and in all bills, invoices, railway receipts, etc., the goods must be distinctly described as margarine or oleomargarine. Failure to comply with these regulations will be held to indicate that the goods are butter.

The inspectors mentioned above (or other special experts appointed by the Government) have the right to enter premises where butter is made for sale, customs stations, ports, and railway stations, to take samples of the manufactured goods prepared as butter, and to transmit such samples to laboratories designated by ministerial decision. Such samples (as well as the expenses of the examination) will be paid for by the State, unless fraud is proved against the proprietor.

Persons knowingly infringing the provisions of the present law are liable to imprisonment for a period of from six days to three months, and to a fine of from £4 to £200. Inability to furnish the name of the seller or consignor will not be admitted as an excuse for infraction of the law. Carriers or transport companies are liable to a fine of from £2 to £20 for carrying margarine in packages not properly labelled. The use of unsound materials or of substances injurious to health will be dealt with under the penal code. A second offence within a year after conviction will always be punished by the maximum fine.

PROPOSED NEW BILL.

A BILL for the Amendment of the Law of the 16th April, 1897, was presented to the Chamber of Deputies by M. LEON MOUGEOT, Minister for Agriculture, on the 3rd March, 1903. The Bill was referred by the Chamber to the Commission of Agriculture.

MEMORANDUM BY M. MOUGEOT.

(*Translation.*)

The preparation of the Act of 16th April, 1897, and the Parliamentary debate thereon showed the difficulties which, in the present state of science, chemists experience when examining butter for margarine, of determining the presence of margarine when existing in a smaller proportion than 10 per cent.

The experience of the six years during which the Act has been in operation has fully confirmed the opinions expressed on the subject in the debates by my predecessors, Messrs. Viger and Méline, by the Reporters of the Parliamentary Commissions appointed to examine the Bill, and by various members of the Chamber of Deputies and of the Senate.

These difficulties in the analysis of butter are well known and they have seriously prejudiced the administration of the law. When expert chemists, while unanimous in declaring the presence of margarine, are not absolutely in agreement as to the proportion existing in the sample of the butter analysed, the Court acquits because of the

Appendix XXXV.

doubt: and, for this reason, the enforcement of the Act of 1897 is becoming increasingly difficult. Our butter exports are thereby seriously affected, and the agricultural press has frequently published legitimate complaints from agriculturists as to the injury thereby caused to them.

It is urgently desirable to remedy this very regrettable situation by recourse to scientific processes capable of disclosing in the clearest manner the presence of margarine in butter, even in the smallest proportion, and thus secure the more energetic suppression of adulteration.

These methods exist; and certain foreign countries, *e.g.*, Germany, Austria, and Belgium, have adopted them. They consist in the addition to margarine of certain harmless substances, such as sesame-oil and starch, which can be easily detected by analysis. The German law of the 15th June, 1897, together with the Regulations of the 4th July following, and the Austrian law of the 25th October, 1901, together with the Regulations of the 1st February, 1902, require the incorporation of sesame-oil; in Belgium the Royal decree of the 31st October, 1900, together with the law of the 4th May of the same year, prescribes the admixture of starch and sesame-oil with margarine intended for sale.

It is advisable to introduce similar conditions into our own legislation, by an Act declaring the principle, and a regulation fixing the details, particularly as regards the selection, the amount, and the mode, of introducing the additional substances; which might moreover be altered with the progress of scientific knowledge. These requirements would as a natural corrolary prohibit the importation into France of butter and margarine coming from countries where it is not compulsory to earmark margarine—not only for internal consumption but also for exportation.

The proposed Bill contemplates the addition of a third and fourth paragraph to Art. 2 of the Act of 1897, and to modify the first paragraph of Art. 22, as follows:—

Art. 2 of the Law, 1897:—

Section 1. All alimentary substances other than butter, which present the appearance of butter and are prepared for the same purpose, can be described only as margarine, whatever be their origin, source, or composition.

Section 2. Under no circumstances may colouring matter be added to margarine as thus defined.

The new Bill proposes the following additions:—

Section 3. There shall be mixed, at the actual time of manufacture, and under the supervision of duly appointed inspectors, substances which, declared by the Consultative Committee of Public Hygiene in France to be harmless and incapable of changing the distinctive character of the margarine, are of such a nature as to facilitate analysis for the identification of this product, whether alone or mixed with other fats.

Section 4. The importation into France is forbidden of butter and of margarine coming from countries which do not compel manufacturers of margarine to incorporate some easily recognisable substances in their products, whether intended for home consumption or for exportation.

Art. 22 of the Law of 1897:—

Section 1. An administrative regulation shall indicate the measures necessary for carrying out the law, especially as regards the establishment and inspection of factories of margarine, and oleomargarine; the inspection of butter factories, of markets, and retail shops where butter, margarine, or oleomargarine are sold; the taking and verification of samples of suspected products; the selection of inspectors and the guarantee of secrecy.

The new Bill proposes the following addition:—

. . . . and for the selection, proportion, and mode of introduction of the additional substances prescribed by Art. 2, Section 3, of the present Law.

IV. GERMANY.

German Margarine Law, 1897.

(Précis).

The principal provisions of the German law of 15th June, 1897, concerning the trade in butter, cheese, lard, and their substitutes, are as follows:—

Premises wherein are sold margarine, margarine-cheese, or artificial fats (which are defined to mean any preparation resembling pure butter, cheese, or lard, respectively) must be provided with notices that such goods are on sale, conspicuously displayed. Vessels and wrappers containing these goods must also bear a similar clearly visible designation, and must further be provided with a red band. The details as to the size, position, etc., of the inscriptions and red streak have been laid down with great minuteness by the Federal Council. All wrappers in which such goods are delivered to purchasers in the retail trade must also bear the proper superscription, and if the substance is exposed for sale in regularly shaped blocks, these must be in the form of a cube. At public auctions, and in all trade notices, invoices, waybills, etc., the designations required by the law must be employed.

The mixture of butter or "butter-lard" with margarine or other fats prepared for food, with a view to trade, is prohibited; and the employment of more than 100 parts by weight of milk or cream for every 100 parts of other fats used in the manufacture of margarine, is also forbidden.

The manufacture, storage, package, and sale of margarine or artificial fats is prohibited upon premises where butter is manufactured, stored, packed or sold, and a similar clause prescribes separate premises for genuine cheese and margarine-cheese. This provision does not apply to the retail trade in localities with less than 5,000 inhabitants (unless the proximity of a town with a population of over 5,000 appears to the local authorities to render it desirable), but margarine, margarine-cheese, and artificial fats must nevertheless be kept in separate vessels, and in a different place from the genuine butter, cheese, or lard.

Margarine and margarine-cheese intended for commercial purposes must contain an addition facilitating the general recognition of the commodity by chemical analysis, but not injuring the constitution or colour.

The manufacture of margarine, margarine-cheese, and artificial fats is subjected to official supervision, and due notice of intention to engage in the business must be given, with all particulars, to the proper authorities. Factories already working must also report the same details. Police inspectors may enter the premises where such goods are manufactured, stored, or sold at any time during business hours to take samples; any information required by them as to the processes employed must be given. The police inspectors are bound upon oath not to divulge any trade secrets thus learned.

The Federal Council is empowered to prohibit the sale of butter of which the fat constituents do not attain a certain standard, or of which the water or salt contents exceed a certain limit.

The law is not applicable to such artificial fats, etc., as are not intended for human consumption, nor to unadulterated fats from certain kinds of animals and plants, if sold under designations corresponding to their origin.

Infractions of the law are punishable by imprisonment up to six months, or to a fine not exceeding £75, or to both of these penalties. In addition, the commodities found adulterated or improperly manufactured may be confiscated. A police inspector divulging any trade

Appendix XXXV.

secrets or using them to his own advantage is also liable to fine or imprisonment to the same amount. A prosecution against a police inspector can only be undertaken at the instigation of the person carrying on the business. Persons refusing to allow the police officials to inspect their premises, making false declarations, or committing other minor infractions of the law, are also liable to fines or imprisonment. This law came into operation on October 1st, 1897, except as regards the provisions relating to the separate sale premises for butter and margarine, etc., which did not come into force until April 1st, 1898.

REGULATIONS FOR THE EXECUTION OF THE MARGARINE LAW.

The resolution adopted by the Federal Council at its sitting on the 2nd July, 1897, concerning the Regulations for carrying out the Margarine Law, declares that, in order to facilitate the recognition of margarine and margarine-cheese intended for commercial purposes, sesame-oil is to be added to the fats and oils used in this manufacture. For every 100 parts by weight of the fats and oils used, the amount of sesame-oil to be added must be at least ten parts in the case of margarine, and five parts in the case of margarine-cheese.

NOTICE CONCERNING THE AMOUNT OF FAT AND WATER CONTAINED IN BUTTER.

March 1st, 1902.

(Translation.)

By virtue of Section 11 of the Law of the 15th June, 1897, regarding the sale of butter, cheese, lard, and its substitutes, the Bundesrath has decided that:—

Butter, which contains less than 80 parts by weight of fat out of 100 or which—when unsalted, has more than 18 such parts of water and, when salted, more than 16—may not be sold or offered for sale in trade from the 1st of July, 1902.

(For the Chancellor.)

(Signed) GRAF VON POSADOWSKY.

NOTE SUPPLIED BY THE GERMAN DELEGATES.

(Translation.)

In addition to the Law of 14th May, 1879, concerning the trade in foodstuffs, there must also be taken into consideration as regards the trade in butter throughout the German Empire:—

(1) The Law of the 15th June, 1897, respecting the trade in butter, cheese, lard, and their substitutes.

(2) The Regulations of the Bundesrath of the 4th July, 1897, giving directions for the execution of the above Law; and

(3) The Regulation dated 1st March, 1902, concerning the contents of water and fat in butter.

According to Art. 10 of the Law on Foodstuffs, the following will be liable to a term of imprisonment, with a fine, or to one of these penalties:—

(1) Whosoever counterfeits or adulterates foodstuffs for the purpose of deceit in trade and commerce.

(2) Whosoever (ignoring this Law) knowingly sells foodstuffs which are unsound, or falsified, or adulterated, or offers such articles for sale under an adapted trade mark.

According to Section 11 of the same Law, the transactions indicated in the above paragraph (2), are also punishable should they be effected through negligence.

Should goods, destined not to serve as foodstuffs or delicacies, be produced in such a way that the use of them as such is liable to injure human health, Article 12 (1) of the said Law, provides that not only the producer, but also the person who knowingly sells, offers for sale, or otherwise introduces them to the market, shall be punishable with imprisonment, and should the transaction entail severe illness, or the death of any person, with penal servitude up to five years. The attempt itself is punishable.

These directions also include butter, so that a fine may be imposed in all cases where admixtures have been made to it, with the object of giving the product the appearance of a better quality, or which, after the addition of foreign fats, is fraudulently sold under an adapted trade mark. The question whether any fraud has taken place is left in individual cases to the decision of the courts, which will rely upon the judgment of experts.

The addition of margarine or other foreign fats to butter is, in addition, also specially forbidden by Section 3, par. 1, of the above-mentioned Law of June 15th, 1897, so that under no circumstances are such mixtures to be produced and sold, even if labelled as "Mixed, Butter," or any equivalent designation.

The minimum contents of fat and of water in butter were fixed by the Bundesrath Regulation of 1st March, 1902. According to that Regulation, butter which is sold or offered for sale must (after the 1st July, 1902) contain at least 80 per cent. of fat, and the water-contents in unsalted butter must not exceed 18 per cent., and in *salted* butter not more than 16 per cent. Whereas, salted butter for exportation only is contemplated, that which is exported to England from Germany is not admissible if it contain more than 16 per cent. of water.

An absolute limit for salt in butter has not yet been fixed, because of insufficient knowledge concerning the necessary maximum required in individual cases. Experiments are, however, in progress, in order to arrive at a decision on this question, and extensive practical investigations are also contemplated. Indirectly however, the amount of salt in butter is already limited by the standards for butter fat and for water, whereby the salt limit (allowing about 1 per cent. of the weight for other ingredients—milk-sugar, &c.), will amount to between 3 and 4 per cent.

The danger lest the amount of water should be reduced, and the amount of salt increased, does not arise, inasmuch as the London Market prefers a mild-salted butter, and a more heavily salted brand would be more difficult to sell; moreover, such an increased addition of salt is not necessary for its preservation, and is not bounded by the preference of any market whatsoever.

German butter for exportation is almost exclusively produced in large dairy factories, which manufacture their produce according to approved methods, and with the most modern technical appliances, *e.g.*, *centrifugal separators*, and the employment of ice during hot portions of the year. Butter from small makers is not exported in any considerable quantities, as its sale would be difficult owing to the varying quality and colour of the product. The salting of butter is effected in Germany exclusively by the *dry* method, that is, by the addition and kneading of the salt into the substance. The application of cold or hot brine is not necessary.

Instructions relating to the inspection of butter are contained in an official document of the 1st April, 1898 entitled "Directions for the Chemical Examination of Fats and Cheese." (*See Minutes of Evidence*, 10506-7, 10516-7, 10524, 10533-41.)

V. HOLLAND.

(Précis.)

The law of the 9th July, 1900, for preventing fraudulent practices in the butter trade in Holland defines butter as an article containing no fat constituents other than those derived from milk; and margarine is defined as an article resembling butter but containing fat not derived from milk. Power is reserved to give another name than margarine to any mixture resembling butter, which may be introduced into the butter trade, but the word "butter" must form no part of such name. All the provisions of this law which are applicable to margarine are also applicable to such mixtures.

Margarine may not be sold, kept in a shop or other place of sale accessible to the public, exposed, conveyed, imported, exported, or kept in stock for transport or exportation, unless the word "margarine" appears in legible letters on all the packages; or if the article is not packed, on the article itself, and the notice must be distinctly visible to the customers and the public.

A dealer in margarine exposed in a market or similar place of sale must place a board above the article on which the word "margarine" is inscribed in distinct letters clearly visible to the public. If both sides of the board are visible to the public, the inscription must be placed on both sides.

When margarine is on sale in a shop used for the sale of that article or for butter and margarine, the inscription "margarine" must appear over the outside door, and on the windows nearest both sides of the door, in distinct letters and clearly visible to the public. Similar inscriptions are obligatory for margarine factories, as also for warehouses and buildings where the article is stored. When butter and margarine are kept in stock in the same shop, or in any other place of sale accessible to the public, the last-named article must either be kept in a separate part of the premises, or be divided from the butter by a partition distinctly visible to the buyers.

Neither on the article itself nor on the package containing it may any other letters than the word "margarine" appear, except the name or the initials of the maker, of the salesman, and of the place of origin, and the indications of the quality of the article generally employed in the trade. In the case of margarine despatched to an address, no additional words may be put on the outer package except the address of the person for whom the article is intended, and the marks which, according to the custom of the trade, are necessary for the transport.

A person convicted twice within two years of offences against the foregoing provisions is prohibited, without special permission, to expose for sale butter and margarine at the same time in the same shop, or any other place of sale accessible to the public, or in the same market.

Certain special officials, known as butter-inspectors and assistant butter-inspectors, together with other officials of the State and Communal Police, are charged with enforcing this law, and these officials are to have access to shops and other premises where butter and such like articles are publicly sold.

The warehouses and conveyances in use by public carriers are also to be accessible at all times to the butter-inspectors.

The officials charged with the execution of the law are empowered to take samples of butter and such-like articles in shops or other premises, or in course of delivery. They are also authorised to take samples of butter and articles resembling butter found on the premises of manufacturers of, or dealers in margarine, which are not provided with the required notices; but samples must not be taken of margarine marked as prescribed. Power is likewise given to these officers to search all means of conveyance (no delay must, however, be caused thereby in the service of a public means of conveyance), and to examine all goods in which it is suspected that butter or articles resembling butter are concealed, as well as goods in which it is suspected that any of these articles are packed.

The law provides that two samples shall always be taken from the same package, and that when desired the market value shall be paid for the samples. Compensation is to be granted to the person interested, on his request, for the damage done to the owner of the articles concerned by taking the samples, if the articles, upon examination, turn out to be butter.

The two samples are to be sealed up by the official and submitted with a statement of the origin of the samples for examination by the experts appointed by the Minister of the Interior. The examination of the samples is to be conducted according to instructions to be given by the Minister of the Interior by at least two sworn chemists working independently of each other, to be appointed by that Minister. The method followed in that examination may be communicated to the person interested. The results of this examination are to be notified by the Public Prosecutor's Department to the person concerned, who may have the second sample examined at his own expense, and for three weeks after this notification the Public Prosecutor can institute no prosecution against the person. The person concerned is also authorised to affix his own seal to the samples.

Offences against certain of the provisions are punishable with imprisonment not exceeding three months or a fine not exceeding three hundred florins; and in the case of a second conviction within two years, with imprisonment not exceeding six months or a fine not exceeding six hundred florins, while the sentence of the Court is to be published at the expense of the convicted person.

For offences in cases where the articles concerned were intended for exportation to foreign countries or to be sent to the Dutch Colonies the maximum punishments are double the above. The maximum punishments are also doubled if the provisions as to marking are not complied with, in cases where both butter and margarine are present.

NOTE SUPPLIED BY THE GOVERNMENT OF THE NETHERLANDS.

(Translation.)

(*a.*) "Netherlands regulations defining the genuineness of butter."—According to first paragraph, Article 1, of the Butter Law, butter is a fatty substance in which no other fatty constituents are present than those which are derived from milk, and margarine is the article resembling butter, which can be used instead of it, and which contains fatty constituents which are not derived from milk.

Furthermore, in connection with this, we must refer to the subjoined instructions issued by the Minister, according to Article 10 of the Butter Law, relating to the methods by which is determined the adulteration or non-adulteration of butter with margarine.

In explanation of this we must observe that the object of applying several methods of examining is to test the result obtained by one method by applying one or more in addition. In this way a greater certainty is obtained than by accepting one single proof of genuineness fixed beforehand for all kinds of butter.

(*b.*) "What deficiency in any normal constituents of butter raises a presumption, until the contrary is proved, that the butter is not genuine?"—Before the year 1900 it was directed by a ministerial decree that butter with a refractomer reading of not more than 53·5 at 25° C. might be considered without further examination as unadulterated. As it has been proved, however, that this figure cannot be accepted unconditionally as the limit of genuineness, this instruction has been withdrawn, and as often as is thought necessary besides the determination of the fatty acids may be effected according to the method of Reichert-Meissl-Wollny or Leffman-Beam and other methods of examination, such as a microscopic examination and the one by means of reaction on vegetable substances (compare the observation under letter *a*). The Netherlands experts are left at liberty in each individual case to interpret, according to their experience, the analytical results obtained by the methods here prescribed with respect to the genuineness, (c.) "What addition of extraneous matter . . . in any sample of butter raises a presumption, until the contrary is proved, that the butter is not genuine."—The Netherlands Police provisions against adulteration of butter apply exclusively to adulteration with margarine. There are no preventive provisions, though there are in the penal code repressive provisions against the addition of extraneous matter.

No official reports have been published on this subject, but an inquiry was instituted in 1895-96 into the composition of Netherlands butter, the results of which were drawn up by Dr. J. J. L. van Rijn, Director of the Government Station of Agricultural Control at Maastricht, and published in 1899 by the Commission of Administration of the Busmalegaat. Those results were at the time communicated to the British Government's analysts. An addition of those data, enlarged by a few later ones, concerning butter from the southern provinces, also by Dr. van Rijn, appeared not long ago in English.

Lastly we wish to say, that in order to complete the knowledge respecting the circumstances which influence the composition of our butters, a further inquiry has been instituted, which will be extended, so far as is necessary, to all parts of the country.

The Minister of "Waterstaat," Trade and Industry of 20th December 1901.

(signed) *de Bosch Kemper*, Secretary-General.

INDEX TO THE EVIDENCE.

PART I.

RELATING TO WATER, AND SALT, IN BUTTER.

Figures in brackets indicate paragraphs of Digests (see pp. vii.—xxviii.)

Argentine Butter - - - 507.
Australian Butter - - - (See *Water in Butter.*)
Belgian Butter—Official standards - - - Appendix XXXIV., XXXV. (II.).
Brine—Use of - - - 682, 942, 967, 1167, 1534, 3083–6, 6662–8, 7534–5, 7765–81, 8465 ; Digests 1 (3), 8 (3), 13 (5), 15 (5), 16 (5), 19 (3), 20 (4), 25 (4), 28 (5), 29 (3–4), 30 (3–5), 31 (4), 32 (3), 33 (3), 34 (3), 35 (5), 40 (5), 41 (4), 43 (3), 49 (3), 54 (4) ; Appendix XIII.
Butter Powders - - - 4014, 7058–70, 7508–13, 8688–93, 11454.
Canadian Butter - - - 1508, 7247–9 ; Appendix XVIII. (1).
Cork Butter-Market - - - Digests 24 (4), 25 (5), 31 (3) ; Appendix XII.
Danish Butter - - - 507, 1309, 1508 ; Digest 3 ; Appendix II., III., XVIII. (1), XXVI. § 3.
Dorset Butter - - - 6979–84 ; Digests 42, 52.
Dutch Butter - - - Appendix XVI.
English Butter - - - Digests 2, 7 (3), 39, 41, 42, 44 (4–5), 47, 51, 52, 54 (5), 70 (4–5). (See *Water in Butter.*)
Experiments - - - (See *Water in Butter.*)
Finnish Butter - - - 442, 7181.
French Butter - - - Digest 81 (2). (See *Water in Butter.*)
German Butter - - - 8511–4, 8694–6 ; Appendix XVIII.
  Official Standards - - - 10494–502 ; Appendix XXXV. (IV.).
Holland - - - (See *Water in Butter.*)
Irish Butter - - - Digests 4 (5), 7 (3), 8 (3), 9 (3), 10–35. (See *Water in Butter.*)
  Creamery Butter - - - 536–551, 1300–4, 1500–1, 1543, 1704–5 ; Digests 10, 11, 12, 15, 16 (3), 20 (2), 21 (3–4), 22, 23, 24, 25, 26, 32, 35. (See *Water in Butter.*)
  Factory Butter - - - 603–6, 702, 1298, 1415, 1505, 1543, 1704–5, 4206–7, 4591–3 ; Digests 15, 26, 32. (See *Water in Butter.*)
  Salt Butter - - - Digests 1 (3), 4 (5), 7 (2), 8 (3), 9 (3), 13, 15, 16, 17 (4), 20 (4), 24, 25, 27, 28, 29, 30, 31, 33, 34, 35, 40 (5), 43 (2–3), 45 (2–3), 49, 54 (4), 55 (4). (See *Brine ; Cork Butter Market ; Statistics ; Water in Butter.*)
Italian Butter - - - 507, 1508.
Legal Evidence - - - Digests 50, 66, 71. (See Appendix XX. and *Part II.*).
Milk-Blended Butter - - - Digests 8 (5), 9 (5), 41 (3), 49 (3), 50, 66, 71. (See *Water in Butter.*)
New Zealand Butter - - - 507, Digest 37.
Potted Butter - - - 7828–33.
Preservatives - - - 3123–5, 4030–1, 6169, 6350–2 ; Digests 13 (7), 20 (5–6), 25 (5). (See *Part II.*).
Renovated Butter - - - 7910–22, 7935.
Russian Butter - - - 507, 551, 1318, 1507, 1547, 6908, 12449 ; Appendix XV., XXXII. (Table I.).

Figures in brackets indicate paragraphs of Digests (see pp. vii.—xxviii.)

SALT - (See *Irish Salt Butter.*)
In butter - 3777, 5063-4, 6200, 9884, 10635-6 ; Digests 1 (5), 8 (6), 9 (6), 10 (4), 12 (4), 15 (5), 24 (5), 26 (3), 33 (4), 35 (4), 37 (3), 41 (4-5), 47 (3) ; Appendix XIII., XVIII., XXX. (p. 579), XXXII. (Table I.).
Dry-salting - 491, 683, 1780-3, 2069-74, 2309, 2708-10, 2930, 3099-104, 4187-8, 4499, 6990, 7001-2, 7289, 7534-5, 8463 ; Digests 13 (7), 15 (3), 20 (4), 28 (5), 29 (3), 30 (5), 31 (4), 33 (4), 34 (3), 35 (4), 40 (4), 46 (2), 49 (2), 52 (3) ; Appendix XIII.
Standard - (See *Water in Butter.*)
Not recommended - 85, 685-6, 6159-61.
Recommended - 2380-4, 10998-9 ; Digests 20 (5), 25 (5).

SCOTCH BUTTER - Digests 5, 38 (4-5), 46, 48, 70 (4-5). (See *Water in Butter.*)

SOCIETY OF PUBLIC ANALYSTS - Digests 40 (2), 44 (2).

STANDARD - (See *Water in Butter* ; *Salt.*)

STATISTICS (Dairy) - 8718-43 ; Appendix XXXIII.
Irish - 18-19, 1978-2014, 2101-9, 3078, 4654-60, 7601-2 ; Digests 8 (3), 16 (5), 20 (7), 24 (4), 25 (4), 31 (3), 35 (4), 43 (3), 55 (4).
New Zealand - Digest 37 (3).
Scotch - 6452-63, 6575-8, 7885 ; Digest 46 (3).
Victorian - Digest 36 (5).

STREAKINESS IN BUTTER - 2860, 3989-92, 4602, 5015 ; Digest 26 (3), 28 (5). 33 (4), 34 (3).

SWEDISH BUTTER - Digest 15 (6) ; Appendix VIII., XVII. (See *Water in Butter.*)

TINNED BUTTER - 446-9, 497, 4170-82, 6232-3, 8087-9, 8102-6.

UNITED STATES OF AMERICA BUTTER - 507, 1508, 8697-8, 8709 ; Digest 67 (3) ; Appendix XVIII. (1), XIX.

VICTORIAN BUTTER - Digest 36.

WATER IN BUTTER - (See *Legal Evidence*).
Analyses, &c. of samples from :
Argentina - 507.
Australia - 507, 1310, 1508, 4945 ; Appendix XIII., p. 313.
Canada - 1508, 7247 ; Appendix XVIII. (1).
Denmark - 507, 608-18, 1309, 1508 ; Appendix II., III., XVIII. (1), XXVI., p. 492.
England - 293, 296, 7182, 10618 ; Appendix IV., XV., XVIII. (1), XXX. (p. 579).
Finland - 7181.
France - 507, 518, 1508-10 ; Appendix XVIII., section 1.
Germany - Appendix XVIII.
Holland - Appendix XVI.
Ireland - 507, 1691-2, 4946, 7999, 10629 ; Appendix IV., VII., XI., XIII., XIV., XXX. (p. 579).
Creamery butter - 548, 1300, 1508, 2649, 2881-90, 3043-7, 3308 ; Digest 21 (3) ; Appendix VI. (B.) and (D.), X., XIII., XV.
Factory butter - 536, 1298, 1415, 1505.
Salt butter - 542, Digests 13 (5), 16 (4) ; Appendix I., VI., IX., XIII.
Italy - 507, 1508.
New Zealand - 507, 6279.
Russia - 507, 1318, 1507, 1547 ; Appendix XV., XXXII. (Table I.).
Scotland - 10619-28 ; Appendix IV., XXX. (p. 579).
Sweden - 507, 4945 ; Appendix VIII., XV., XVII., XVIII. (1).
United States of America - 292, 507, 1508 ; Appendix XVIII. (1), XIX.
Various countries - 6695, 7448, 8177.
Victoria - 6209.
Wales - Appendix XV., XXX. (p. 579).
Analytical method - 6836-42, 10616-7, 11663, 11685-6 ; Digests 7 (5). (*See* also Digest 20 (3), and Q. 5893-900.)
Causes affecting amount - Digest 1 (4), 2 (4), 3 (3), 4 (5), 5 (3), 6 (2-3), 7 (3), 8 (5), 10 (2), 11 (3), 12 (3), 13 (6), 15 (3), 16 (4), 17 (3), 20 (3), 21 (3-4), 22 (3), 23 (3), 24 (3), 25 (3), 27 (2), 28 (4), 29 (4), 30 (3), 31 (2), 33 (2), 34 (3), 35 (3), 37 (3), 38 (3), 39 (3), 40 (4), 41 (3-4), 42 (2), 44 (5), 45 (3), 51 (3), 52 (3), 54 (3) 70 (4) ; Appendix XIII., XVIII., XXVI.

Figures in brackets indicate paragraphs of Digests (see pp. vii.—xxviii.)

WATER IN BUTTER—*continued.*
Experiments - 293 *et seq*, 4876-83, 4955-67, 5066-5107, 5208-30, 8511-14, 8697 ; Digests 38 (3), 41 (3), 46 (3), Appendix XIII., XIX.
Fraudulent addition - Digests 4 (4), 7 (4), 12 (4), 20 (3), 21 (4), 24 (3), 25 (3), 7 (2), 29 (4), 32 (3), 40 (4), 41 (3), 43 (4), 44 (6), 76 (2) ; Appendix XVIII. (p. 328). (See *Milk Blended Butter.*)
Standard for Water in Butter - (See *Footnotes* (*a*) *and* (*b*).)
Evidence against - Digests 16, 20, (31), 48.
Evidence regarding a limit of :
12 per cent. - Digest 37.
14 per cent. - Digests *26*, 34, 36.
15 per cent. - Digests 6, 9, 15, 20, 21, 22, 23, 26, 30, 34, 35, 36, 39, 40, 42, 43, *49*, 54.
16 per cent. - Digests 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, *13*, *15*, 18, 26, 32, 33, *38*, 39, 40, 41, 42, 43, 44, 45, 48, 51, 52, 54, *55*, 66 (3-7), 68 (3), 71 (3-4), 72, 74, 75, 76, 77.
16·5 per cent. - Digest 46.
17 per cent. - Digests 11, *15**, *26**, 38, 81.
18 per cent. - Digests 9, 11, 16, 17, 24 25, 27*, 29, 30, 31, 32, 33, *38*, 39, 43, 45, 68 (3), 77.
19 per cent. - Digests *38*, 43.
20 per cent. - Digests *13**, 16, 18, 23, 42, 43, *49**, *55**.
22-24 per cent. - Digests 16*, 17*.
24 per cent. - Digest 20*.
25 per cent. - Digest 43.
Working limits - Digest 44.
·9 per cent. - Digest 1.
1·0 per cent. - Digest 4, 10, 21, 39, 40, 44.
1·5 per cent. - Digest 9.
2·0 per cent. - Digest 7.
3·0 per cent. - Digest 30.
Alternative Standard :
Amount of butter-fat - 2353-8, 6356-7, 10494-502 ; Digest 47 (2).
Objections - 6744-5, 7474.
Analogy with Standards for— (See *Part II.*)
Butter-fat - 8179-85, 10157.
Milk - 10157, 10359-66, 10841-2 ; Digest 54 (2).
Tobacco, &c. - 1258-66, 3313-24, 8157-8, 10846-56.
Dual Standards - (See *Footnote* (*a*).)
Evidence against - Digests 1, 4, 5, 7, 24, 29, 30, 32, 40, 41, 43, 44, 45, 46, 48, 50, 51, 52, 55.
Evidence in favour - Digests 9, 10, 13, 15, 16, 17, 20, 26, 35, 38, 43, 47, 49, 54, 55.
Salt differentiation - Digests 7, 13, 20, 29, 35, 40, 43, 44, 47, 49, 54.
In Belgium - Appendix XXXIV., XXXV. (II.).
Germany - Digest 68 (3) ; Appendix XXXV. (III.).
Notice regarding standard - 281-7, 4954, 7359, 7419, 11330 ; Digests 11 (2), 15 (2), 35 (2), 50 (3), 54, 66 (2), 71 (2).
WELSH BUTTER - 6944-56, 10582 ; Digest 53 ; Appendix XV., XXX. (p. 579).
WITNESSES : (See *Part II.*)
Digest of Evidence - pp. vii.
List of - pp. iii.

(*a*) See the second paragraph of each Digest where not otherwise specified.

(*b*) Italics refer to dual standards, and asterisks to salt butter.

Index :-
Part II.

PART II.

RELATING TO THE "OTHER CONSTITUENTS" OF BUTTER OTHER THAN WATER AND SALT (*See* Part I.).

Figures in brackets indicate paragraphs of Digests (see pp. vii.—xxviii.)

- Acetic Acid test - 3583-5, 9273, 9570-5, 9581 9606 ; Appendix XXIV.
- Adulteration of Butter - 2379, 3456-88, 4905-25, 8179-85, 9327-8, 9442-9, 9603-17, 9901-2, 10119-25, 10153-5, 10266-71, 11304-16 Appendix XXIV. (See *Standard.*)
  - and the law - (See *Legal Evidence.*)
  - checked by :—
    - absence of a standard - 9361, 9545-7.
    - a reasonable limit - 10186.
    - colouring margarine - 9282.
    - "control" system - (See *Control.*)
    - economic conditions - 10174-5.
    - existing chemical methods - 9314, 9320, 9353-4, 9688, 10172-7.
    - the law - 10201-2.
  - chemical standard cannot prevent - 9081-4.
  - detection - 9342-3 9347-52, 10438-40, 10533, 10542-6, 10674-5, 10704-6, 11264-72, 11455-60, 11552-8, 11746, 11827-33. (See *Research.*)
  - historical sketch - 10119-25 ; Appendix XXVI., § 16.
  - in Belgium - Appendix XXXIV.
    - France - Digest 81 (4).
    - Germany - 10545-6.
    - Holland - 9184-203, 9216-9, 11932-6.
    - Ireland - 2590-1.
    - Russia - Digest 80 (6).
    - U.S.A. - Digest 67 (3).
  - increase - 11304-9, 11314-6. (See *Standard.*)
  - research work required - (See *Research.*)
- Adulteration of Cream with starch - 11447-53.
- Age of the Cow—influence of - 10755, 10925.
- Analyst's Certificate :—
  - addition of "remarks" - 9620-9.
- Angell Method - 9314, 10119 ; Appendix XXVI., § 16. (See *Hehner.*)
- Argentine Butter - 10183.
- Austro-Hungary—legislation - Appendix XXXV.
- Baudoin Reaction - 10539-40. (See *Sesame-oil.*)
- Belgium :—
  - standard for butter fat - 9058, 9220-4 ; Appendix XXXIV, XXXV.
- Blending, influence of - 12592.
- Bömer, Dr., Researches of - 10533, 10542-4.
- Branding of butter - 9998-10002 , Digests 67 (3). (See *Control.*)
- Breed, influence of - 3480, 3495, 8992, 10439, 10648, 10752-3, 10923, 11478-9, 12025, 12049, 12174-7, 12523 ; Digest 79 (3) ; Appendix XXIX.
- Butter-fat :—
  - composition - 3456-66, 8869-84, 9268-72, 9312-3, 9326-8, 12517-23 ; Appendix XXIV., XXVI.
  - in British samples - 10638 ; Appendix XXX., pp. 578-9. (See *Part I., Water in Butter.*)
- Calving - (See *Lactation.*)
- Cholesterin - 10533.

Figures in brackets indicate paragraphs of Digests (*see pp.* vii.– xxviii.)

CLIMATE, influence of - 9038-9, 9303, 9730, 9747, 9798-814, 9824-5, 9959-62, 10151-2, 10180-6, 10573-5, 10582 10610, 10685, 10754-9, 10927-59, 11438-9, 12106, 12152-7, 12213, 12238, 12561; Appendix XXVI, XXIX.

COCOANUT OIL:
  butter adulterant - 8903, 8906-9, 9269, 9271, 9571, 9605, 9654-67, 11041, 11724-34.
  detection - 8915, 9272, 9571, 11042-3.
  raises the Reichert-Wollny No. - 11726; Appendix XXIV.

COMMERCIAL VALUE of Butter.
  and Reichert-Wollny figure - (See *Quality.*)

CONTROL of Butter:— - Digests 57 (3), 63 (4), 73 (2-3), 78 (2-3). (See *International Conference.*)
  alternative to a standard - 9081-101, 9123, 10179, 11186-8, 11881-928, 11950-9.
  in Denmark - Digest 63 (3-4); Appendix XXVI., §§ 14, 15; XXVIII.
    Hamburg - 10547-51.
    Holland - Digests 57 (3), 78 (3); Appendix XXIII.
    Norway - 9890.
    Sweden - 11206-8.
    U.S.A. - Digest 67 (3).

COTTON-SEED OIL:
  butter adulterant - 8903-5.
  detection - 8910-2, 9571, 11727-30.

COURT OF REFERENCE - 9519, 11589.

DAIRY SCHOOLS:
  abnormal butter samples - 11443-6; Digests 70 (4-6), 79 (4); Appendix XXIX., XXX., pp. 517-9, 527.

DANISH BUTTER - Digest 63; Appendix XXVI., XXVIII.
  abnormal cases in 1888 - 9265-7, 9294-311, 9355-7, 9958-74; Appendix XXVI., § 13-15.
  control of - (See *Control.*)
  uniformity - 9972-6, 10037, 10110-3.

DENSITY of Butter - (See *Specific Gravity.*)

DIMETHYLAMINOAZOBENZENE - (See *Margarine ear-mark.*)

DISCOMFORT OF THE COW, influence of - 9826, 10758. Appendix XXVI. § 11; XXIX.

DUTCH BUTTER - Digests 57, 58, 78; Appendix XXII., XXIII., XXXV. (v).
  adulteration - 9184-203, 9216-9, 11932-6.
  composition - 9124-9 9162-83, 9204-15, 9225-59, 9372-3, 10125, 10235, 11005, 11286-91, 11371, 11398, 11624-8, 11670-82, 11746, 12619-20; Appendix XXII.
  control - (See *Control.*)

EAR-MARKING Margarine - (See *Margarine.*)

EARTH-NUT OIL:
  butter adulterant - 8903-5.
  detection - 8913-4.

EDUCATION (Dairy):
  influence of in Denmark - 9305-9.

ENGLISH BUTTER - (See *Reichert-Wollny.*)
  composition - 9000-2, 10640, 10920-7, 10965-7; Appendix XXI., XXIX., XXX.; Diagrams, pp. 509-31.
    official inquiry - Digests 70 (4-6), 79.

EXERCISE of the cow, influence of - 9819 26.

FATS ("foreign") used for butter adulteration - 8885-900, 9327-8

FISH OILS, as butter substitutes - 9270.

FOOD, influence of - 3487-92, 3606-10, 3659, 8911, 8992, 9034-9, 9137, 9226, 9244, 9303, 9462, 9485-6, 9730, 9745-7, 9959-62, 10539-41, 10610, 10641-50, 10685, 10693, 10923, 10939-41, 10966-7, 11261, 11438-40, 12148-57, 12236, 12293-7, 12316-8, 12523, 12559-64, 12574, 12605-6; Appendix XXVI. (pp. 496-7), XXIX.

FRENCH BUTTER - 9038; Digest 81; Appendix XXI.
  legislation - Digest 81 (4); Appendix XXXV.
  official method of analysis - 12529-43, 12567-9, 12621; Digests 60 (3), 77 (3).

Index:—
Part II.

Figures in brackets indicate paragraphs of Digests (see pp. vii.— xviii.)

Friesland - (See *Dutch Butter.*)

"Genuine" butter - 10352–5.
restricted meaning proposed - 11387–94.

Geological Formations, influence of - 12626.

German Butter - 10495, 10927–59, 10968.
legislation - Digest 68 (3–4); Appendix XXXV.

Hehner Method - 8917–42, 9273, 9514, 10119, 10564–6, 10669, 10695–6, 11025–30, 11116–22, 11361, 11393–4, 12567–8.

as a standard process:
(a) Insoluble acids - 10230.
89 per cent. limit - 11251–7, 11275–6; Digest 75 (3–4).
90 per cent. limit - 11030.

(b) Soluble acids:
4·5 per cent. limit - Digest 77 (3).
compared with R.W. method - 10698, 11025–9, 11119–20, 11255–7; Digest 75 (2–4).
variations observed - 8920–31, 11022; Appendices XXI., XXIV., XXIX., XXX. (p. 583), XXXII.

Hübl Method - (See *Iodine Absorption.*)

Individuality of the cow - 3480–3, 3599–609, 9138–44.

Inquiry (Official)—
into composition of British butter - Digests 70 (4–6), 79; Appendix XXIX., XXX.

International Conference - 6258–9, 6314–7, 10063, 10397–401, 10678, 10991, 11265, 12103, 12116, 12233, 12316, 12319, 12323, 12478; Appendix XXXIV.

Iodine Absorption - 3577–82, 8980–1, 9347–52, 9570, 10121, 10154, 10230, 10533, 10560–1, 10775; Appendix XXI., XXIV., XXVI., XXVII., XXXII. (Tables I. and XII.).

Irish Butter:
adulteration - 2590–1.
composition - 9192, 9165–89, 9548–51, 10125, 10203–7; Digests 16 (5), 21 (6), 29 (5); Appendix V.
official inquiry - Digest 70 (4–6); Appendix XXIX., XXX.; Diagrams (pp. 553–75).

Italian Butter - 9038; Appendix XXI.

Koettstörfer method - 8966–76, 9273, 9570, 10119, 10533, 10669.
as corroborative test - 12579–80.
values - Appendix XXI., XXIV., XXVI., XXVIII., XXIX., XXX. (Diagrams and p. 588), XXXII.

"Keeping," influence of - 12183–7, 12291–2, 12595–7.

Lactation Period, influence of - 1717–28, 1750–3, 1860–3, 3468–79, 3549–55, 8992, 9008, 9135–6, 9144–55, 9307, 9476–89, 9730, 9962–80, 10664–10, 10640, 10716–7, 10733, 10767, 10926–7, 10937–8, 10962, 11260, 11438, 12124–5, 12291–306, 12318, 12590–1; Digest 79 (4); Appendix XXVI. (p. 497), XXIX.; Diagram (p. 507).

Leffmann-Beam method - 1716–7, 10506, 10520.

Legal Evidence - 10495, 11394–8; Digests 50, 61 (2), 66, 71, 75 (6) 78. (See *Part I.*)

Legislation - (See *Margarine* and *International Conference.*)

Margarine:
as an adulterant - 10163; Appendix XXI., XXIV.
dietetic value - 9344–6, 10193–7.
Dutch - 9334–41, 11929–36.

ear-marking: - 9282, 9835–40.
with dimethylaminoazobenzene - Appendix XXXV. (L.)
phenolphthalein - 9837.
sago flour - 9525–30.
sesame-oil - 9526–41, 9838, 10534–41; Appendix XXXIV., XXXV.
starch - 10541; Appendix XXXIV., XXXV.

MARGARINE—*continued.*
legislation :
in Austria - - - Appendix XXXV. (I.)
Belgium - - - Appendix XXXIV., XXXV. (II.)
Denmark - - - 9947.
France - - - 12581–3 ; Appendix XXXV. (III.)
Germany - - - 10534, 10541 ; Appendix XXXV. (IV.)
Holland - - - 9201–2, 9216–9, 11809–11 ; Appendix XXXV. (V.)
Hungary - - - Appendix XXXV. (I.)
New Zealand - - - 6317.
Norway - - - 9733–41, 9835–43.
Russia - - - 12114–18, 12256–66.
Sweden - - - 11161–5, 11176, 11212–6.
U.S.A. - - - Digest 67 (3).
Victoria - - - 6257.
Norwegian - - - 9766–78, 9844–58.
Reichert-Wollny No. of - - - 9616–7 ; Appendix XXI, XXIV.

MICROSCOPIC ANALYSIS OF BUTTER - - - 9285–91, 9410.

MILK STANDARD - - - (See *Standard : analogy.*)
has checked adulteration - - - 9363–4.
improved the quality of milk - - - 9366.

MOLECULAR WEIGHT of insoluble acids - - - 10669 ; Appendix XXX. (p. 584).

NILSON, PROF. - - - (See *Lactation*).

NORWEGIAN BUTTER - - - 10660–7 ; Digest 62.

OILS (VEGETABLE) - - - (See *Cotton-seed oil, etc.*)
as butter adulterants - - - 8892–909.
German Regulations - - - 10505, 10534–41.

ORIGIN OF BUTTER - - - 3545–76, 3654–8, 10037–90, 10228, 10231, 10395–412, 10974–7, 11572–4 ; Digest 73 (3).
margin in respect of - - - 9322–6, 9360, 9388, 9550, 10974–7, 12532, 12541, 12619–20 ; Digest 72 (4–5).

PALM-NUT OIL, butter substitute - - - 9271.

PHENOLPHTHALEIN - - - (See *Margarine ear-mark.*)

PHYTOSTERIN, detection of adulteration - - - 10533–9.

POTASH ABSORPTION - - - (See *Koettstorfer.*)

PRESERVATIVES : - - - (See *Part I.*)
Departmental Committee - - - 10999–11003.
prohibited in : Denmark - - - Appendix XXVI. (§ 2).
Germany - - - 10530.
Norway - - - 9836.
U.S.A. - - - 10459–62.

"PROCESS" BUTTER - - - 10417–20.

QUALITY OF BUTTER :
and the Reichert-Wollny Number - - - 9012, 9116–21, 9279, 9317–8, 9365–7, 9903, 9916–23, 9991–3, 10156, 10187–97, 10688–91, 11299, 11317–20, 11747–51, 11819, 12235, 12315–6, 12337–51, 12455, 12560, 12565–6, 12593, 12604, 12608 ; Appendix XXVI. (p. 493–6).
improved by a standard - - - 9046, 9367.

REFRACTION - - - 8982–9, 9273, 9287, 9351–2, 9450–64, 9490, 9570, 9683–4, 9725–30, 10121, 10154, 10230, 10506–7, 10516–9, 10555–9, 10669, 10738 ; Digest 75 (3–4) ; Appendix XXI., XXII. (B), XXIV., XXV., XXVI., XXVII., XXIX., XXX. ; Diagrams, and p. 585 ; XXXI., XXXII., and p. 635.

REFRIGERATION, influence of - - - 3686–99, 3721–4, 12241

"REGULATIONS" - - - 9499–513, 11380–3, 11394.

REICHERT METHOD - - - 8944, 10119, 10127, 10218, 11640–2, 11689–734 ; Digests 75 (3–4), 76 (5). (See *Reichert-Wollny.*)

Figures in brackets indicate paragraphs of Digests (see pp. vii.—xxviii.)

REICHERT NUMBER:
- 12 as a standard - 11710; Digest 75 (3-5).
- 11 ,, ,, ,, - 11030.
- 10 ,, ,, ,, - 11718.

REICHERT-MEISSL METHOD - 9735-6, 10506-7, 10519-33, 10567, 10909-12, 11020-2, 11340-2. (See *Reichert-Wollny.*)

REICHERT-MEISSL NUMBER:
- 21 as a standard - 11030.

REICHERT-WOLLNY METHOD - 8944-65, 9273, 9413-35, 9570-7, 10208-25, 11456-514, 11641-2, 11757-9; Appendix XXVI., § 16.
- as a standard - 10228.
  - the best available - 2416, 8945-65, 9005, 9019, 9278-9, 9283, 9401, 10567, 10698, 10971, 12233, 12580.
  - concordant results - 9501, 10698, 10776, 11483-4.
  - insufficient test - 12321, 12476-82.
  - sorting method - 9400.
  - supplemental test - 10708-11, 10728, 10771-6, 11262, 12579-80.
  - useless alone - 9604-5, 9656.
- compared with the—
  - French "Official Method" - Digest 81 (4).
  - Hehner method - (See *Hehner.*)
  - Leffman-Beam method - 1716-7.
  - Reichert method - 10119, 10127, 10218, 10228, 11640-2, 11689-734; Digests 75 (3-4), 76 (5).
  - Reichert-Meissl method - 9735-6, 10567, 10909-12, 11020-30, 11340-2; Digest 75 (3-4).
  - specific gravity - 10669, 10776.
- Society of Public Analysts Committee, and the - 11478-85, 11509-10, 11643-6.

REICHERT-WOLLNY NUMBER:
- and quality of butter - (See *Quality.*)
- as a standard - Digests 21 (5), 56 (2), 59 (2-3), 61 (3), 70 (2), 72 (4), 74 (2), 75 (3-4), 77 (2-3). (See Q. 10229.)
  - 20 c.c. - 9370, 9383, 10980, 10990.
  - 21 c.c. - 9370, 9732, 10979, 11030, 11068, 11081.
  - 21·5 c.c. - 1931, 4925.
  - 22 c.c. - 9369, 9718, 10208-9; Digest 72 (4).
  - 22·5 c.c. - 12539-40.
  - 23 c.c. - 3556-70, 3620-31, 9718, 10988-90; Digest 80 (3).
  - 24 c.c. - 9371, 9579, 9698-11, 9717, 10274-5, 10971, 10988-90, 11145, 11251, 11745, 11760, 11765-6, 12578, 12621; Digests 70 (2-7), 75 (3), 80 (3).
  - 24·5 c.c. - Digest 74 (2).
  - 25 c.c. - 9006, 9371-91, 9437-49, 9543-7, 9630-3, 9705-11, 9714-5, 9733-8, 9745-55, 9900, 9994-5, 10107-8, 10129-37, 10530, 10971, 11837; Digest 57 (2), 58 (3).
    - in Belgium - 9058, 9220-4; Appendix XXXIV., XXXV.
  - above 25 c.c. - 9440-1, 9603.
- limits of variation in butter - 3548-75, 8948-56, 9030-8, 9384, 10130-7.
  - Colonial - 9714-6.
  - Continental - 9716.
  - Danish - 9944-67, 10022-5; Appendix XXI., XXVI.
  - Dutch - 9372-3, 12619; Digests 57, 58; Appendix XXII.
  - English - 9697-717, 11765-6; Digest 72 (7); Appendix XXI., XXX., p. 577; Diagrams, pp. 509-31.
  - Finnish - 10145.
  - French - 9038, 12528, 12571-3, 12612; Appendix XXI.
  - German - 10524, 10530-3.
  - Irish - 3548-60, 4911-2, 9548-9, 10203-7, 11765-6; Digest 10 (5); Appendix V., XXX. (p. 577); Diagrams (pp. 553-75).
  - Italian - 9038, 11047, 11056; Appendix XXI.
  - Norwegian - 9725-32, 9745-50, 9827-8, 9866-7, 9889; Appendix XXV.
  - Russian (including Siberian) - 9372-3, 9924-43, 10126-50, 11058, 12309, 12327; Digest 80 (3-9); Appendix XXVII., XXXI., XXXII., (Tables I-X.).

Figures in brackets indicate paragraphs of Digests (see pp. vii.—xxviii.)

Reichert-Wollny Number—*continued.*
  Scotch - Appendix XXX. (p. 577); Diagrams (pp. 533–51).
  Swedish - Appendix XXI.
  Welsh - (See *English.*)

Research Work required - 4906, 9020–3, 9044–5, 9273–7, 9291–3, 9404–6, 9514–24, 9906–15, 10027–34, 10153–5, 10162–4, 10234, 10284–6, 11763, 12430–3.

Russian Butter (including Siberian) - Digest 80; and
  composition of - 8186–99, 9002, 9010, 9324–6, 9372–3, 9924–43, 9991, 10076–8, 10126–50, 10235, 10660–72, 10680, 11013 11058–9; Appendix XXVII., XXXI., XXXII.
  export - Digest 80 (5).
    via Denmark - Digest 63 (3).
  marking proposed - 11572–4.

Sago-Flour - (See *Margarine ear-mark.*)

Salt - (See *Part I.*)

Saponification - (See *Koettstörfer.*)

Scotch Butter—official inquiry - Digests 70 (4–6); Appendix XXIX., XXX.; Diagrams (pp. 533–51).

Season—influence of - 8994–9004, 9036, 9445–6, 9462–75, 9485, 9730, 9793–826, 9958–62, 10146, 10151–2, 10927–59, 12106–11, 12287, 12600; Digests 57 (3), 58 (2), 70 (6–7), 79 (4); Appendix XXVI. (p. 497), XXIX.

Sesame Oil:—
  butter adulterant - 8903–5, 9571.
  detection - 8910–2, 9652–3, 10539–42.
  margarine ear-mark - (See *Margarine.*)

Siberian Butter - (See *Russian butter.*)

Society of Public Analysts, and Committee *re* limit of butter in margarine - 11478–84, 11510.
  and a standard for butter-fat - 11321–2, 11378; Digest 65.

Soltsiensche Reaction - 10539.

Solubility in Absolute Alcohol - 12579–80.

Specific Gravity of butter - 8976–9, 9273, 9288, 9351, 9490, 9570, 9725–30, 10120, 10230, 10562–3, 10669, 10776; Appendix XXIV., XXVII., XXIX., XXX.; Diagrams and p. 586; XXXI., XXXII.

Stabling—influence of - 9008, 10151–2, 10186, 10230, 10652, 10927–59, 11280–91, 11440, 12239–41, 12248, 12293–7, 12316–8, 12399, 12523, 12575. Digests 57 (2–5), 58 (2), 62 (4); 70 (6–7), 79 (4); Appendix XXVI., § 11, XXIX.

Standard (Chemical) for butter fat - (See *Adulteration.*)
  alternatives - 9560–1, 9682, 11587–93. (See *Control.*)
  analogy with standard for:
    articles of revenue, etc. - 10846–56, 11388, 11526.
    milk - 1915–38, 9014–8, 9279–82, 9317–23, 9363–6, 9561–9, 9586–98, 9620–9, 9634–52, 9916–7, 9991–2, 10029–34, 10156–7, 10187–9, 10359–66, 10683, 10841–2, 10986–7, 11013, 11023, 11043–5, 11060–72, 11145–52, 11335–7, 11381–3, 11623–4, 12330–6.
      "*Clacton case*" - 11629–34.
      Dyke v. Gower - 11395.
    water in butter - 8179–85, 10157.
  composite standard - Digest 60 (2–3), 61 (3), 72 (4), 74 (2), 75 (3–4), 81 (3).
  corroborative tests - (See *Reichert-Wollny method*)
  desired by analysts - 10228, 11310–1, 11378–9, 11388, 11619, 11720–3; Digest, 65. (See *useful to.*)
  effect of:
    a high standard - 9279, 9321, 9367, 9391, 9412, 9542, 9603, 9692–6, 9898–900, 10035, 10567.
    a low standard - 9078–80, 9116, 9279, 9321, 9359–60, 9403, 9412, 9542, 9579, 9598, 9692–6, 9898–900, 10093, 10228, 10567, 11059, 11247–9, 11531, 11587, 11835–6, 11906.
  in Belgium - Appendix XXXIV., XXXV. (II.).

Figures in brackets indicate paragraphs of Digests (*see pp.* vii.—xxviii.)

STANDARD (CHEMICAL) for butter fat—*continued.*

- legal aspect - 11035-7, 11073-9, 11312-3, 11384-98; Digests Nos. 50, 59 (2-3), 61 (2), 66, 71, 75 (6).
- "notice" necessary - 9007-10, 9046-7, 10230.
- seasonable standard impracticable - 12105, 12232.
- Society of Public Analysts, and - (See *Society of Public Analysts.*)
- useful to analysts - 9358, 9374-82, 9560, 9619, 11023, 11112, 11334, 11619, 11744.
- useful to magistrates - 10810-1, 11023, 11334, 11351.
- witnesses' opinions:
  - favourable - Digest 13 (4), 21 (5), 56, 70, 72, 74, 75, 77, 81. See also Q. 9278-9, 9283-4, 9399-401, 9575-8, 10807-11, 10971-80, 11515.
  - none expressed - Digests 14, 73. See also Q. 10393, 10503, 10553.
  - unfavourable - Digest 10 (5), 57, 59, 60, 61, 63, 64, 65, 76, 78, 80. (See also Q. 4905-12, 9887-8, 12031.)

STARCH - (See *Margarine ear-mark.*)

SWEDISH BUTTER - 10660; Digest 73; Appendix XXI.

TEMPERATURE, influence of - (See *Weather.*)

UNIFORMITY OF BUTTER—

- produced by:
  - a standard - 10671, 11529, 11279.
  - co-operative dairying - 10110-3.
  - system of calving - 9973-80. (See *Lactation.*)
  - other causes - 12291-7.

UNITED STATES OF AMERICA - Digest 67.

VALENTA'S TEST - (See *Acetic Acid.*)

WEATHER, influence of - 8992, 9008, 9176-7, 9745-7, 9798-826, 10610, 10641, 10657, 10758, 11990, 12473-4, 12561. (See *Climate, Stabling, Season.*)

WELSH BUTTER - (See *English.*)

WITNESSES - (See *Part I.*)

- digests of evidence - p. *xxi.*
- list of - p. *xix.*

COMMITTEE ON BRITISH FORESTRY.

MINUTES OF EVIDENCE

TAKEN BEFORE THE

DEPARTMENTAL COMMITTEE

APPOINTED BY THE

BOARD OF AGRICULTURE

TO INQUIRE INTO AND REPORT UPON

BRITISH FORESTRY;

WITH

APPENDICES AND INDEX.

Presented to both Houses of Parliament by Command of His Majesty.

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1903.

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CONTENTS.

	PAGE.
List of Witnesses	iv
Minutes of Evidence	1
List of Appendices	139
Appendices	141
Index	221

6131. 1250—Wt. 12278.—4/03. Wy. & S

LIST OF WITNESSES EXAMINED.

PAGE.
Mr Samuel Margerison, English Timber Merchant, representing the Timber Trades Federation of the United Kingdom - 1
Mr. Charles Hopton, Vice-President of the Timber Trades Federation of the United Kingdom - 12
Colonel Frederick Bailey, R.E., Lecturer in Forestry at Edinburgh University, Member of the Committee - 12
The Right Hon. Earl of Selborne, Landowner - 23
Sir John W. Ramsden, Bart., Landowner - 27
Mr. Andrew Slater, Land Steward, Osborne - 30
Mr. William Brewis Havelock, Forester - 34
Mr. A. C. Forbes, Forester - 42
The Right Hon. Lord Glanusk, Landowner - 48
Mr. Donald Robertson, Forester, representing the Royal Scottish Arboricultural Society - 54
Mr. John Davidson, Land Agent, Secretary to the English Arboricultural Society - 62
Mr. Arthur Vernon, Land Agent - 66
Dr. W. Schlich, C.I.E., F.R.S., Principal Professor of Forestry at the Royal Indian Engineering College, Coopers Hill, Member of the Committee - 72
Mr. Dudley W. Drummond, Land Agent - 85
Mr. Alexander Pitcaithley, Forester - 90
Mr. John H. Croxford, of Messrs. Price, Walker & Co., Timber Merchants - 92
Colonel Frederick Bailey, R.E., re-called - 94
Mr. John T. Maxwell, of the Scottish Local Government Board - 97
Major P. G. Craigie, Assistant Secretary to the Board of Agriculture - 99
Dr. William Somerville, D.OEC., Assistant Secretary to the Board of Agriculture, Member of the Committee - 104
Mr. C. O. Minchin, of the Inland Revenue Department - 111
Mr. A. D. Webster, representing the Royal Horticultural Society - 113
Mr. John Michie, Commissioner to H.M. the King at Balmoral, representing the Highland and Agricultural Society of Scotland - 117
Professor H. Marshall Ward, D.SC., F.R.S., representing the University of Cambridge 123
Mr. Joseph Parry, Chief Engineer to the Liverpool Corporation Waterworks - 130
Mr. Martin F. Roberts, M.INST.C.E., of the General Post Office - 135

MINUTES OF EVIDENCE

TAKEN BEFORE THE

DEPARTMENTAL COMMITTEE

ON

BRITISH FORESTRY,

AT ST. STEPHEN'S HOUSE, WESTMINSTER, S.W.

FIRST DAY.

Tuesday, 22nd April, 1902.

PRESENT:

Mr. MUNRO-FERGUSON, M.P. (*Chairman*).

Sir JOHN F. L. ROLLESTON, M.P.
Mr. EDWARD STAFFORD HOWARD, C.B.
Professor W. SCHLICH, C.I.E., F.R.S.
Colonel FREDERICK BAILEY, R.E.
Professor JOHN R. CAMPBELL, B.SC.
Mr. JOHN HERBERT LEWIS, M.P.
Mr. GEORGE MARSHALL.
Dr. WILLIAM SOMERVILLE.

Mr. REGINALD H. HOOKER, *Secretary*.

Mr. SAMUEL MARGERISON (English Timber Merchant, of Calverley, near Leeds) called; and Examined.

Mr. S. Margerison.
22 Apr. 1902.

1. (*Chairman.*) You are a representative of the English Timber Committee of the Timber Trades Federation of the United Kingdom, and are yourself a large timber merchant?—Yes, I am.

2. You are accompanied by Mr. Hopton, so that if any member of this Committee desires further information than you give, Mr. Hopton, who is Vice-President of the English Timber Trades Federation, will be glad to supplement it?—Yes.

3. In following your statement (*Appendix III.*) it is apparent that you regard foreign methods in forestry as producing, on the whole, better financial results than British methods in forestry?—I do.

4. You believe, nevertheless, that certain qualities of timber are found in greater perfection in Britain than in foreign countries?—Yes, in qualities useful for certain purposes.

5. Therefore, to supply certain limited requirements, you think it is better to grow trees singly or in a thin crop than in dense plantations?—Yes, for certain limited requirements, but for general financial results certainly the Continental method is better, particularly I think the German, from my own experience of what I have seen there.

6. Therefore, in the main you would advocate the growth of the greatest possible bulk of clean timber upon any given area?—I would.

7. And that not only as affording the best returns, but as supplying the chief wants of the market?—Yes, exactly.

8. The conditions to which you refer in your statement—that of being able to obtain clean, long, straight timber—are the conditions that are required for practically every purpose, from building timber to pit props?—Yes, exclusive of things where resistance to indentation is of greater importance, where durability on exposure to weather is concerned, and where the timber is required in short lengths and not in particularly long lengths. In the case of those kinds of timber, the trees grown under what I may call the present conditions general in this country, are more suitable—where short length, durability, weight, density, and toughness are required. But where long lengths, as you say, are required for building timbers, the Continental timbers are more suitable, and, of course, are more available where cheapness of production is of importance.

9. For building timber as well as for other purposes the highest quality is generally obtained in the foreign timber, which commands, therefore, more favour and a higher price?—Yes, because of its greater length of grain and freedom from cross grain owing to having been grown in longer annual lengths, as distinguished from larger annual girth. Foreign timber seems to be grown more with a long "cone upon cone" annual growth, and so there is longer space between the knots and there is less cross grain, and the timber generally is freer from rough knots and similar defects.

10. Without divulging any trade secrets, could you give any comparative prices as between home and foreign-grown building timber, pit props, or battens, having regard to your examples of cases where one timber commands a higher price than the other?—My business is especially amongst English timber, and very little amongst foreign; I have so little to do with foreign timber that I should scarcely feel my evidence on that point would be valuable to you. It is a point on which Mr. Hopton, our Vice-Chairman, could enlighten you, and I should be glad if he could give evidence on that matter.

11. We might ask that of him presently; but it is within your knowledge that for certain purposes foreign timber does command higher prices than English?—Yes. For my own private purposes when building I have had to pay higher prices for foreign timber than for English timber. For instance, red deal is very dear in comparison with Scotch fir, spruce, and the fir tribe generally. If we come to oak, one has to give higher prices for British oak than for foreign oak, but at the same time I consider it is of higher value.

Mr. S. Margerison.

22 Apr. 1902.

12. You believe, nevertheless, that home-grown coniferous timber ought to be, for most purposes, as good as the foreign grown, providing that it has been as well managed?—I think so. I have had occasional lots of English-grown spruce and Scots pine as free from knots, as clean, and, in my opinion, quite equal to foreign spruce and pine.

13. Taking the British system of growing trees singly or in a thin crop, and obtaining, in consequence, the higher prices to which you refer, does not the loss to the landowner involved by the extra land occupied under that system amount to more than the extra price received for the wood?—I have not gone into that in detail so as to give a mathematical calculation with regard to it, but from my general experience I should say certainly, considerably more loss.

14. I may take it that you consider that all coniferous timber should be grown dense, and probably most kinds of hard wood also?—Yes, I should not be very positive about the larch; the spruce, the Scotch fir, and most of the pines and firs, I think should be grown densely in order to procure the best results, both in quality and in quantity.

15. I observe that you are in favour of working plans; do you think that they would be an advantage to the merchant and to the grower?—Yes.

16. A methodical arrangement of the timber areas?—Yes. I am sure of that.

17. This would probably secure a more regular supply of timber for the market?—Yes.

18. Would more regular fellings obtain easier terms for the transport from railway companies?—That is rather a difficult question to answer. Unfortunately, where there is no competition, railway companies are difficult to manage, but I think there is a feeling growing amongst some of the railway companies that regularity in the supply of large consignments would be one means of inducing them to give easier rates for carriage. Another point is that if there were regular supplies, especially in large quantities, in a certain district, there would be possibilities of converting, or partially converting, the timber on the ground, and forwarding it by the railway companies in that partially or wholly converted form, and we should stand a better chance of saying to the railway companies—I do not want to use a strong term, but nothing more applicable occurs to me at the moment—something with regard to the inequality of differential rates—I do not wish to use the term "preferential"—as accorded to foreign timber over English, because, as the railway companies say, imported timber is in a more handy form. They send deals, battens, and boards at a considerably lower rate than we can send round timber, and possibly if we had larger areas with regular consignments we might have a better means of sending our timber in the form of deals, battens, and boards, and consequently have more convenient consignments for the railway companies and cheaper rates.

19. Do steam transport on roads or water carriage have any check on railway charges?—My experience of water carriage generally is that the railway companies have had such control of it that it costs almost as much—I am speaking now of English water carriage—as any other form of transport; there is very little difference between the railway company and the canal company now.

20. And what do you say as to steam haulage by traction-engine?—I have not tried it, but I am told that steam haulage on suitable roads is considerably cheaper than a combination of horse haulage and railway carriage.

21. How would you deal with the railway companies to secure those lower rates in any other way than by competitive forms of transport?—I do not know of anything better than competition, or alteration of the existing state of things by Act of Parliament. Round timber, even for intermediate stations, is carried at a very considerably higher rate of carriage than square timber from ports. I have some rather startling figures on that point. By Act of Parliament round timber is placed in a higher classification than square timber. If I may mention one or two instances now, I can give illustration of what I am saying. This is what one member of our Federation has reported to us, and we could give you hundreds of instances, but I think a few probably will show you the principle. From Hull to Birmingham, about 130 miles, imported deals 13s. 4d. per ton measurement weight. Derby, an intermediate station, to Birmingham, about 40 miles, English round timber 11s. 2d. per ton measurement weight. Gloucester to Birmingham, imported deals 6s. per ton measurement weight, that is 65 cubic feet to the ton. Gloucester to Birmingham, English round timber 11s. per ton, 40 or 50 cubic feet to the ton according to the species. We have hundreds of such cases, but that would perhaps just give you an idea of the principle.

22. It gives us a very good idea. With regard to provision for transport in the actual plantation, do you find that woods are, as a rule, conveniently laid out with roads or rides, or any other provisions, to enable the merchant or forester to extract his timber conveniently from the felling areas?—Yes; that is a most important matter in the haulage of timber, having good roads, well planned. It is as well to get an easy down gradient, if possible, to the exit, with as good a surface as can be afforded.

23. Is that what you usually find provided for you in English woods?—No.

24. Do you prefer to fell and lot your purchases, or to have it done for you?—Personally, I do not mind which way it is done; on the whole, perhaps, one prefers to fell.

25. Is the plant in British saw-mills up to foreign standards?—Those in the towns probably are, but that is a thing I have not had quite so much experience of as I think Mr. Hopton has. He has seen saw-mills and plantations not only in Germany, but in Austria and Hungary. In America the mills are in the woods, and they are in that particular more advanced than they are on the Continent. There are very large areas to cut out there, with water-floatage and other facilities, and there is no need to move about the appliances to the same extent as is done here or on the Continent.

26. Are most of the men connected with the timber industry or the timber trade very well qualified to value standing timber?—I think the responsible men are.

27. I will give you one or two practical examples that occur to me. Is it a matter of common knowledge amongst your men or amongst ordinary foresters or wood managers, how many cubic feet there would be in a given wooded area in the various stages of its growth, say, from 30 years to 120 years? Do you employ any men for valuing?—I do my own valuing.

28. Do you find that the men with whom you are brought in contact are usually able to tell what the weight of the wood is—how many cubic feet of wood there is upon the ground?—Usually, speaking in very general terms. Of course, there are instances where men do not know, but I find they are very rare, and they are increasingly rare, especially as we are gradually getting more and more Scotsmen into the places of the English foresters.

29. Is that because they are better educated?—I think they are better foresters.

30. Of course it needs training?—Yes; it needs training, and that is the point.

31. But you think that most of the men you come in contact with would be able to tell you how many cubic feet of marketable timber there were in a certain wood as it stood?—Yes, given time and opportunity. I do not mean that they could do it at a glance, but given proper opportunities I believe the responsible men could estimate it very nearly.

32. And knowing the quantity, do you think they could give a reliable opinion as to whether there was too much or too little at any time?—No, I do not think they could, speaking broadly. I think that again is one of the points on which education is required.

33. If a forester puts a value on a standing tree, do you think he usually knows what price per cubic foot he is getting for it?—My experience is that he usually does.

34. Would he know what the timber cost per ton or cube to move to the railway station, to the wharf, or to the consumer?—In my experience, yes, generally.

35. And what it would cost per cube to haul it to the saw-mill, or cut it into the usual scantlings or boardings for estate purposes or for the market?—On conversion he may require some education and experience, more than he has, generally speaking.

36. Do you think it to be the case that most owners and agents, and occasionally some foresters and buyers, are deficient in knowledge regarding the management of their work?—They seem to know more of the selling part of the business than they do of the management

of the woods—they seem to know that part of the business better than they know the management. They do not know about rearing and getting the best crops. I am speaking broadly, and, of course, there are brilliant exceptions.

37. Have you any views as to what kind of training is most required for foresters or those who have to deal with the utilisation of forest products?—One of the first essentials is, I think, that it should be easily obtainable, because a forester under present rates of remuneration could not afford three years at a university in order to learn the whole of the necessary details of his education. I think that is one important point, that the education should not be at one particular centre only, but should be distributed, perhaps by the present machinery (the local colleges through the country), so that local men might attend, say, evening classes with reasonable ease, much in the same way as the agricultural and other classes are conducted at such places as the Yorkshire College.

38. Do you think that adequate precautions are taken by private owners and by the State against wind and fire, either by maintaining shelter belts, or insisting on proper safeguards being used in the construction of locomotives?—In my experience I have not come across any serious accidents from those causes, and so I am not prepared to answer that question as it should be answered.

39. Do you believe that the United Kingdom might be made self-supporting in the matter of timber?—In the larger quantity of timber that we require I believe it could.

40. (*Mr. Stafford Howard.*) Does that apply to both hard wood and soft, such as pine?—More particularly to pines; but, of course, there are many kinds of hard wood that could not possibly be grown in this country because of the climate. But I believe we could grow the larger quantity of the woods mostly used, including ash, of which there is a great scarcity, and it would be a most valuable timber to plant at present under suitable conditions. Then there is oak, which, of course, would take a longer time to realise. I honestly believe that British oak is better than any other oak.

41. You could not do that without extending the area?—No, we could not, but there is plenty of available land at present which, if it could be by any means planted, would hold immense crops of timber. The crop on the present wooded area could be vastly improved.

42. Do you think there is a great quantity of land which is not now planted where it would pay to plant oak?—I think so. I had an instance of that the other day. I was valuing timber on an estate which has been transferred, and the timber in a plantation of 50 acres was worth close on £4.000—roughly £80 an acre. It varied in age from 25 years to 80 or 100 years, judging by the look of it. Half the adjoining farm was of exactly the same character of soil, poor stiff land. I am not now speaking of rough mountain pasture, or anything of that sort, but of fairly low-land country. This land was let to a farmer, with a good homestead (which would cost to-day £1,500 to build), at 7s. 6d. per acre, the landlord paying the rates. I feel sure, judging from the crop and soil on one side of the fence, and the character of the soil on the other, that that land would pay much better if it were utilised for growing ash and oak than it does at present for agriculture.

43. Did you make any calculation as to what the crop on the ground was worth per acre, taking it for the whole time it was growing, comparing it with the agricultural rent?—I should not like to bind myself to the figure, because, to a certain extent, it is an actuarial valuation which I do not feel myself competent to be definite upon in a moment; but I certainly think it would be worth nearer 20s. than 7s. 6d. This place is within four miles of a railway station, within fifty miles of a mining district, and within fifty miles of several large towns. There is a population of some millions within less than one hundred miles.

44. (*Professor Schlich.*) As a general proposition, I should think that if you put the agricultural rent at more than 7s. 6d., the financial aspect of forestry becomes a little doubtful?—From 7s. 6d. to 10s. is perhaps about the figure. The means of transport is one of the most important factors. In fact I consider it the most important thing in a question of this kind. If you have to fell the timber 200 miles away, and it is a low-priced timber at the delivery end, it makes all the difference. If you have to pay, as we have in Yorkshire, 3d. for the carting, and possibly 4d., it makes a great difference. Our firm has paid 5d. per cubic foot for carting Scotch fir in the early seventies, when prices were better than they are now; and it had to be felled, which would make a good hole in another penny. We paid 3d. a foot for the railway carriage, and at that time the Scotch fir was sold at 16d. a foot, but to-day it would have to be sold at 8d. Therefore, the 5d. for cartage and the 3d. for railway carriage would now swallow up the whole of the selling price. This was within the same county, and, as the crow flies, there was a distance of less than 40 miles between the point of production and the place where the timber was consumed. Only recently I was speaking with a man who has been taking down a plantation of spruce, and he is going to deliver it into the market for the owner, and they will share whatever is left after the expenses are paid. He anticipates that they will each have ½d. per cubic foot if he is very fortunate. In this case also, both the growing place and the delivery end are within the bounds of Yorkshire, so that transport is the most important thing, especially with cheap timbers.

Mr. S. Margerison.

22 Apr. 1902.

45. (*Mr. Stafford Howard.*) You lay great stress on the importance of having good roads for the purpose of extracting timber, particularly in large woods?—Yes.

46. If you were offering to buy timber in some large woods, the question of whether there were good roads by which to get it out, or bad boggy roads, or heavy roads at the time of year you had to get it is important, and you would take all those things into your calculation?—Yes.

47. And it would make a good deal of difference in the offer which you would make?—Yes. It would make a considerable difference; and the railway rate would make possibly even more.

48. I was thinking of it more from the point of view of the owner?—Yes, from his point of view. The cost of cartage might not be more than 1½d. or 2d., but in the case of railway rates it might be 2d., 3d. or even 4d. for comparatively short distances.

49. (*Professor Campbell.*) You use a large amount of British timber, do not you?—I handle a large amount of British-grown timber.

50. And not much foreign?—Not much foreign.

51. Do you find increasing difficulty in getting supplies?—Just recently perhaps one has, especially in the case of good ash and good oak.

52. The home supply is not restricted very much yet, is it?—Yes. I think during the last few years it has been, especially of good ash.

53. Do you look forward to the time when it will be very restricted?—I do.

54. In the near future?—In the near future.

55. Unless planting operations are extended?—Yes. In the case of the best British oak, and in the case of ash, I think if we do not plant, and attend to our present crops better than we have done, and work the whole of our sylviculture on a better system, there will be a scarcity in the near future, especially as regards the higher qualities.

56. From what areas do you draw your supply chiefly?—Principally Yorkshire; but I also go to the adjoining counties. I have bought in Ireland, Wales, and Scotland, but not to a great extent. I buy principally in Yorkshire, because of that old question of cost of transport. One cannot go over very wide areas, because the cost of transport is so heavy that it would not pay to bring the stuff over. Mr. Hopton reminds me of an instance where it was impossible to bring a large quantity of larch from the West of Ireland because of the cost of transport, although larch has a comparatively high value.

57. In your experience, do the persons from whom you purchase re-plant?—Yes, in some cases, but not in all. In a few cases they are already planting on better principles. I have directed their attention to Dr. Schlich's work, and to Professor Somerville's and other people's writings, and I think in a few instances that is beginning to have an effect. For example, I have seen some estates where a few years since they would have planted their trees 5 feet or 4½ feet apart, where they are now planting them 3 feet apart.

58. Now they are planting amongst the roots of the trees which had been cut down?—Yes, but not in every instance. Sometimes it is promised that it should be

Mr. S. Margerison.

22 Apr. 1902.

done next year, and when next year comes it is said it may be done next year, and so on, always the year after.

59. They leave their land lying unproductive?—Yes.

60. Do you find an increasing interest taken in forestry amongst landowners?—I do.

61. What is that due to, do you think?—I think it has been a great deal due to the writings of the gentlemen I have referred to, and I believe perhaps one of the most important steps that has ever been taken in connection with British forestry was the excursion of the Royal Scottish Arboricultural Society to Germany in 1895. I believe very few things, if anything, have had such an influence upon British forestry.

62. As the result of that excursion and these writings you think a greater interest has been taken in forestry, and that the subject is more widely discussed?—That is so.

63. I believe you come a great deal in contact with foresters. Do you find that in this country they agree in their opinions?—No; I do not. I find they disagree. There is a conservatism, and a conservatism not of the right sort perhaps. For instance, they stick to the old method of thinning heavily.

64. Of course you are not in a position to say whether they are wrong or not—you do not profess to be a forester?—I have taken a great interest in forestry, and I certainly consider, speaking broadly, that the proper thing is not to thin too much, but to keep an overhead canopy. With regard to training trees, I am told by Mr. Hopton that lopping is better understood abroad, especially in France, as I have heard Mr. Hopton say before; but, in my opinion, natural lopping in many cases, in the case of the firs and the pines, by crowding, produces better results than artificial. It is the case also with the hard woods very often, unless the artificial lopping is done very carefully.

65. Do you think that the English foresters are becoming converted to the Continental methods?—I think so, and I am very glad it is so, but the conversion is not yet complete.

66. But you think there is distinct evidence that they are beginning to be more of one opinion?—I do.

67. And that that is due to writings and discussions?—I am sure of it.

68. In fact, it is due to a general interest being taken in the matter?—Yes. What is required now, I believe, is the instilling of those principles more generally amongst all classes. If we are going to grow timber as a business we might conveniently in the plantations think a little less of the æsthetic value of our woods, not that it necessarily need be much less. We can confine our arboriculture to the parks and go in for sylviculture in the woods.

69. Are you of opinion that trees grown on the English system are of better quality than trees grown on the Continental system?—For certain purposes.

70. I rather gathered that it injured the quality of the timber to grow it on the Continental system—at least, that was the impression on my mind?—For some purposes. For instance, in the case of beech, we get much heavier crops of beech in Germany than we do in this country. When I was on the excursion I have spoken of we saw a crop of beech of 9,700 cubic feet to the acre. Six of us estimated it independently and averaged our results, and that was the average calculation. We did not vary very much. I doubt whether we have many crops of beech in this country of more than 3,000 cubic feet to the acre. German beech being grown like that makes a heavier crop, but there are uses to which beech is put in this country in large quantities for which that beech is utterly unsuitable. For instance, mallets, shuttles, wheel cogs, rollers, and similar products, where density and weight are of importance, English grown beech, grown more thinly on the ground, is of more value. In confirmation of this I wrote to a large customer the other day asking him what his opinion was, and this is his reply, that such German beech as we have was much inferior to our "English beech, being light in weight, too free and open, and it had not that solidity about it that ours had." We can grow beech of the soft quality, and we have little patches of it, and it may be useful for some kinds of work, possibly the High Wycombe chair trade.

71. The point I want to be clear about for my own information is this. Supposing you grow trees on the Continental system, the dense system, and on the English system where they are sparsely grown, would the trees grown on the dense system be inferior in quality to those grown on the English system?—They would for purposes of this kind where resistance to indentation is of importance, or weight is necessary.

72. Have you had any experience of Irish timber?—Not very much.

73. Are you aware whether it is a good quality or not?—So far as I have seen oak it varies, and ash varies pretty much as ours does. I have handled some quite as good quality of Irish oak as I have of English oak.

74. In Ireland there are a large number of small farmers who cut down individual trees here and there. I suppose that the prices obtained for the timber from isolated trees of that kind would not be so good as when you bought a large quantity in the wood?—No, because the cost of handling 100,000 cubic feet of timber concentrated is less proportionally than handling smaller lots. You could handle 100,000 cubic feet of timber much more easily than you could handle 100 lots of 1,000 feet each.

75. So that it would not be desirable to plant in small lots?—It would be more desirable to plant in large areas. If it is possible to get it by any means, Government or otherwise, that is a most important thing: that we should plant in large areas, having regard—it is very much like "King Charles' head" and cannot be kept out—to the ease and cheapness of transport.

76. Small farmers in Ireland, and I suppose in Scotland as well, are strongly advised to plant corners here and there, but you do not think that that is so desirable from a timber point of view?—From a timber point of view, but for other purposes there are most important matters to be considered. There is shelter, which is a very important point. Besides shelter, tree planting, as most of you know better than I do, has a considerable influence upon climate, and I should like to suggest that among other owners, many of our large urban Corporations owning the freehold of the gathering grounds for their water reservoirs might improve the value of their ground, both in attracting and conserving, and perhaps in improving, the quality of, their water, by planting forests, and in the course of time they would have also a valuable asset in the shape of timber. I have seen, in the way of business, large areas, collecting grounds for large reservoirs for the towns, rough pasture, which could not be used very much for farming because of the defiling of the streams. In fact, I have seen an instance where farms have been bought for the express purpose of pulling down or controlling the buildings in order to preserve the purity of the water. In cases like that it seems to me an important thing that the water gathering grounds should be planted with timber. There would be fewer rushes of water in flood time, and the water would be conserved and let down more gradually, and in some cases—of course I am not much of a chemist—I think possibly the quality of the water might be improved.

77. Are the Yorkshire Corporations planting their gathering grounds?—I hear that Halifax is intending to do so. I was thinking at the moment especially of Leeds and Bradford, but I hear that not only Halifax, but Leeds, may possibly plant.

78. Has the Leeds Corporation planted?—Not yet. I was thinking of the Leeds Corporation particularly at the moment, because I have been brought into personal contact, in one way or another, with cases where they have bought farms for the express purpose of doing away with the defilement of the water, and that land is suitable for the growing of timber, if this is done in a proper manner.

79. (*Sir John Rolleston.*) They are buying up the Washburn Valley Watershed now, I believe?—Yes. It is the Washburn Valley that I am referring to now, where they may possibly plant the trees.

80. Is it a very suitable ground for planting?—It is very suitable if done judiciously.

81. (*Mr. J. H. Lewis.*) Which do you consider financially the most profitable crop that can be grown at the present time in the British Isles?—That depends on a good many circumstances. Speaking generally, if the ground and the environment are suitable I think ash is the best thing to plant and conserve.

82. Would you also consider that pit wood, within a reasonable distance of colliery districts, would be a profitable crop?—I have my doubts. I am speaking now from my local experience in Yorkshire. It may be more profitable in Scotland and Wales to grow pit wood than it is in Yorkshire, but we are so heavily

Mr. S. Margerison.

22 Apr. 1902.

handicapped in the way of transport that it does not seem to be a profitable timber to plant in that district.

83. Do you consider that larch disease makes larch at the present time too risky a crop to cultivate?—Yes, I do, unless the newer kind, Japanese larch, is proved to be more proof against it than the older kinds.

84. With regard to education do you find amongst the older foresters any prejudice against novel methods and against education?—Yes, I do.

85. They prefer the rule of thumb methods?—Yes, "what their fathers have told them."

86. But I think you said that that prejudice to some extent was disappearing at the present time?—It is but not so much amongst the older foresters as among the rising generation, and perhaps more particularly amongst the owners.

87. In travelling about the country have you noticed whether spoil heaps are being planted to any great extent in colliery districts, where large areas of spoil heaps are left?—I have seen very few spoil heaps planted, and I see a good many of them. Many of the collieries are too near to the manufacturing towns for any efforts of that kind to do much good; there is a pollution of the atmosphere which, combined with the poor soil, would, I am afraid, prevent in many cases any tree thriving at all.

88. But I presume there are districts in which, if either the colliery proprietors or the landowners became thoroughly interested in the question, it might be possible to plant on a very considerable scale these spoil heaps, and so convert them from spoil heaps to places of beauty?—Yes, that could be done. I have seen one or two instances where it has been done with very good effect. Although not perhaps growing the best of timber, still it does away with the ugly look of the spoil heaps.

89. Supposing that owing to the stimulus of interest in timber growing in this country extensive areas were afforested, what effect do you think that would have upon rural labour?—I think it would bring people back from the towns, and encourage to stay on the soil much of the labour which is at present drifting away owing to lack of employment and lack of interest, which is cumulative, in that as a district gets depopulated there is naturally less human interest to keep those who still remain on the spot.

90. You think it would have a tendency to keep them in the country?—I do.

91. And with improved methods of education do you think it would give them a greater interest in their work than they now have?—I think it would. It may be perhaps going a long way, but I should like to suggest, if it were possible, that some influence should be brought to bear on those who have the making of children's reading books. A little chapter or two possibly, written by someone who knew what he was saying, might be the means of stimulating in early life an idea of general principles in growing trees. Perhaps the American Arbor Day might be a useful institution to introduce into this country.

92. Is it not the fact that the work in connection with afforesting fills up the labourer's year; that is to say, it gives him work at a time of the year when he most stands in need of it?—That is so. At harvest time as a rule there is not much work in the woods, but in winter when there is not quite so much field work he is wanted in the woods. I find that the men I employ locally, apart from the men I take from my own place, are just the men who are busy among the farmers in the summer, and are very glad to have a fall of timber going on in the district in order to employ them at what would be otherwise slack times.

93. (*Professor Schlich.*) I should like to ask one or two questions to bring out some points a little more clearly. You said in your evidence that, for certain purposes, timber grown in this country is superior to that which we get from abroad?—Yes.

94. What kind of timber does that chiefly refer to?—Speaking broadly, hard woods, beech, oak, ash, and I think I may include elm, but I should not be certain of elm.

95. Am I correct in saying that it chiefly refers to the hard woods?—It chiefly refers to the hard woods.

96. Do you happen to be able to tell me in a rough sort of way what would be the difference in price between English grown beech and German grown beech per cubic foot or ton: the proportional value in the English market?—German beech would be 60s. to 80s. per load of 50 cubic feet.

97. That would be an average of about 70s.?—Yes, about that. British beech would be from 55s. to 65s. I have delivered scores of thousands of feet of trees, not butts—I am speaking of round timber. I am delivering English round timber to-day at 13½d. per cubic foot.

98. That would be practically something about 60s.?—Yes.

99. You are speaking of round timber?—Yes.

100. But that will not afford a means of comparison?—That is taking the whole tree as far as it is measureable.

101. Supposing you cut the same sort of stuff in one case out of the English beech, and in the other case out of the German beech, could you give me an idea how much per cent. more you would get for the English beech than the German beech—5 per cent., 10 per cent., 15 per cent., or what?—Perhaps I had better ask Mr. Hopton, who has had more experience with German beech than I have, to answer that.

102. We will consider it as received from Mr. Hopton. (*To Mr. Hopton.*) Mr. Margerison made a point that for certain purposes English-grown beech is more valuable than German-grown beech. I should like to get an idea of what is the approximate difference in the price between the two, the same class of stuff?—(*Mr. Hopton.*) English butt beech, that is the prime part of the tree, for pianoforte making and other purposes, would realise from £5 to £5 10s. per load. There is no German beech that I know of which will take the place of English for that purpose. But for chair-making, English beech will sell at from 60s. to £5 a load, whereas German beech will sell from about 60s. to 75s. or 80s. a load.

103. Then one might say one would be 70s. and the other about 80s.?—(*Mr. Hopton.*) Yes, for the same purpose.

104. That would be one-seventh more?—(*Mr. Hopton.*) Yes, or about 14 per cent. What I am referring to now is where the wood is required of greater density than the German wood is required for, because the English beech is far denser and of greater tensile strength than the German.

105. (*To Witness.*) The point I am driving at is this: If you get 15 per cent. more, taking a round figure, for English beech as compared with German, you agree that in beech grown under the German method, if you get 15 per cent. more timber, you are just as well off as you were before, and if you get 20 per cent. or 25 per cent. more timber per acre, you, of course, make more profit?—(*Witness.*) In quantity, but not in quality. The German beech would not be suitable at all for the purpose.

106. I am looking at the financial aspect of the question?—Financially you would get better results from the German system than you would from the English.

107. As regards conifers you are strongly of opinion that the imported timber, generally speaking, is considerably superior to what we grow in this country?—I am quite sure of that.

108. And you refer especially to firs and pines?—Yes. I do not know any reason why we cannot grow them; in fact, I think we can.

109. We shall come to that. I want to draw your attention first to the fact that of the imports of timber into this country 87 per cent. consist of firs and pines?—That is in bulk, not in value.

110. That is the official return. Now what I want to bring out is this, that as far as British forestry is concerned, do you agree that the production of coniferous timber is of the first importance, of far greater importance than the production of hard woods?—There is no doubt that it is more important, but there is no reason why the two cannot be carried on together. It is more important that we should produce a large quantity of coniferous timber than of hard woods.

111. That is my point. The next thing I want to lead you to is this. You have in your paper, and I think in your evidence, said that when you deal with coniferous timbers, pines and firs, the cost of bringing it to the places of consumption, or where it is worked up, comes practically to the same amount as you would pay for the original cost of the timber where felled?—Yes, that is so.

Mr. S. Margerison.

22 Apr. 1902.

112. What we have to try to do is to produce coniferous timber in such a way that it could be delivered at the place of consumption at a very considerably reduced rate?—That is the point.

113. So as to reduce the percentage or the proportion between the cost of bringing it and the cost of production?—Yes. The cost of handling our English conifers is often 90 per cent. of the selling value. That is chiefly a question of transport. I could give you scores of instances where the timber has cost 90 per cent. of its selling value in getting it from the plantation to the consumer.

114. On what would the reduction in the cost of bringing it to market principally depend? Would it depend in the first instance on the fact that a large quantity of timber was produced in one particular locality?—Yes, and then in persuading the railway companies that they should give some facilities for native produce of the same kind that they give to foreign.

115. The greater the quantity you have to cut in one and the same locality, the better arrangements you can make for transport, say to the nearest railway, or to where you utilise the timber?—Yes.

116. You can have a more complete arrangement in sawing machinery for cutting up?—Yes.

117. If you have more permanent arrangements for working up the timber in the locality in which it is grown, the reduction in the weight and the transport is very considerably reduced?—Yes, it is.

118. Have you any idea, taking it altogether, what that would come to?—No; of course there is not so much waste to carry.

119. Would that waste reduce the weight 30 or 40 per cent.?—In converting round timber into square the waste can be very easily from 20 per cent. to 33 per cent., but that waste may be used as fuel.

120. In other words, you would reduce your cost of transport by 20 per cent. to 33 per cent.?—Yes.

121. Say 27 per cent. as an average, and that would be a considerable saving?—That would be a considerable saving.

122. If we had concentrated areas of some considerable extent, would it not generally increase the competition for that timber?—Yes.

123. Would it not be likely to reach higher initial prices, if produced in considerable quantities in one and the same spot?—Yes, where there is facility for transport. Of course, if the transport, as at present, cost more than the selling value, I do not think it would affect it to a very great extent. If there is not much margin to begin with there is not much room for competition. When it costs as much to bring timber from the North Riding of Yorkshire to the West Riding as it does not from the Baltic or even from Canada, there is not much room for competition even with the larger quantity of the produce. There is not much room to improve prices.

124. But supposing your imports from the Baltic or Canada should fall off?—Then comes the opportunity for British growers. I do not put this forward from personal observation, but from statistics, that crop apparently is getting less, and in other countries it is getting much more remote every year, and the timber famine is, I think, within perhaps not measurable distance, but appreciable distance.

125. You have already told us in your evidence that you are most anxious that an improved method of forestry education should be introduced into this country?—Yes.

126. There is the working forester, the proprietor, and the estates manager?—Yes.

127. Would you consider it more important in the long run, in the first instance to instruct and enlighten the proprietor and the estates manager, or would you consider it of more importance that the workmen should be better instructed?—I think, looking at it broadly, that on the whole it is more important that in the first place you instruct the owner and then the manager.

128. I am pleased to hear you say so?—After the owner perhaps the keeper. The reason I speak of the owner is because he would have control over the keeper. If an owner is instructed I think much of the other will follow.

129. I am very pleased to hear you say so. You are quite clear that the most important matter is to instruct the owner?—Yes, or whoever has the control.

130. That is the principal point I wished to bring out?—The other will, I think, follow. It is important that the forester should be instructed, and instructed thoroughly.

131. If the owner is instructed he will see that his forester gets instructed too?—He will. With regard to teaching botany in schools and in universities, although it is fairly extensively done, I think botany should be taught with special reference to sylviculture, which is a very important thing to aim at.

132. We are going to have both, I hope?—I hope so.

133. I only wanted to know which you considered the most important?—I think a most important point to keep in view is that the remuneration of a forester should be higher than it is at present, so as to attract a higher class of men, and warrant a man in going in for a somewhat costly education. I think, if I am not wrong in my recollection, in Germany the forester is a combination of a forester and game-keeper.

134. Yes, to a certain extent?—A combination seems to be the ideal thing, but he should be a forester first and a keeper secondly. An important point I think is the distribution (especially when you come to educating agents and foresters) of forestal education over wider areas. When you come to educating the agents and the foresters the means of education should be available in many centres. Coopers Hill and Edinburgh, looked at from the general standpoint of forestry education in this country, are bright spots, but we might have bright spots in Yorkshire, in Birmingham, in Manchester, and in various other places where people who are locally interested may have opportunities to learn true principles.

135. Apart from Coopers Hill, do not you think that the instruction of the proprietor might be more concentrated?—Yes, that might be, naturally.

136. Whereas the instruction of the working forester should be distributed over the country; I understand that is what you mean?—Yes, that is so.

137. (*Colonel F. Bailey.*) The one or two questions that I have to ask relate almost entirely to the transport question. You said that the growing of pit wood was not likely to be profitable in Yorkshire because the cost of transport was so high as to be practically prohibitive. But the miners who are using timber have to get timber down to the mines somehow or other, and they have to pay for it?—Yes, they prefer a smooth light wood.

138. Smooth round timber?—Yes; even a miner does not like to scratch his hand with a knot.

139. It is not altogether the cost of transport, but rather the question of the suitability of the material?—Yes; no doubt it is partly, but I think it is principally the cost of transport.

140. Why cannot we compete with the wood that they get, the smooth stuff received from abroad? It has to be got, and they have to pay for it?—But ours costs so much in handling.

141. It is really a question of the comparative rates, the favourable rates granted to foreign timber?—That is so. This is a point upon which I should like you to question Mr. Hopton. There is a system of granting bounties on exported timber from other countries, but it is a point on which I have not much information myself, and one on which Mr. Hopton can speak.

142. We shall be happy to hear him on this?—It is a thing of which I have no personal knowledge, but I have suspected it. As I have said, the British timber trade has so many ramifications that one man cannot possibly know every branch of it.

143. You have said that it is not only a question of the heavy rates imposed for the transport of British timber, but it is also because foreign timber is more suitable for mining wood?—That is a very important point. Both causes operate unfavourably.

144. If we grew our pit wood in a manner different from the present method of growing it, we might produce something which would be much more acceptable to the miners than that which we now offer them?—I believe that is so; in fact, I am sure of it.

145. That is important. You mentioned just now that 5d. per cubic foot was the sum you paid for carriage or cartage?—I gave that as one instance where we paid 5d.

Mr. S. Margerison.

22 Apr. 1902.

146. What do you mean by "cartage"—do you mean using a cart on wheels?—A timber waggon from the plantation, as distinguished from railway carriage.

147. Through the forest, picking up the timber, and carrying it somewhere?—Yes taking it to a railway station.

148. I daresay when you paid that high rate you found these trees scattered about?—No, this was all in one plantation, within a ring fence.

149. How far did you have to take the timber?—Ten miles.

150. That is a long way, is it not?—It is a long way; it was through a rough country.

151. You are aware, no doubt, that in other countries, where forestry is organised more than it is here, and where the trees are grown in large masses—I do not mean density only, but over extensive contiguous areas—that many means of cheapening and facilitating transport are introduced. For example, slides, shoots, or tramways, or such things as that?—Yes.

152. And you have seen, I daresay, that it would be impossible to organise any such systems of transport unless you had, in the first place, large areas, and, in the second place, dense stock upon them, and, in the third place, a regular system of management?—That is so.

153. So that it seems—and I should like your opinion upon this—that even if we actually got a very great cheapening of those heavy items of transport, if we grew our woods on large, extensive, and contiguous areas, densely packed with wood, and had an organised system, it would be better?—Yes, that is a very important point in improving our sylviculture.

154. There is another point I should just like to call your attention to. You drew a comparison between the prices charged, I understood, by railways for conveying timber, and I think you put it from Gloucester 6s. for imported deals, and 11s. for English round timber?—Yes, that is what is quoted by a member of the Timber Trades' Federation.

155. You mentioned also that the imported deals were 66 cubic feet to a ton?—Yes.

156. And that English round timber was 40 or 50 cubic feet to the ton?—Yes.

157. I suppose in the latter case the English round timber was measured by quarter girth?—Yes, quarter girth, tape over bark, probably.

158. You are aware, of course, that you cannot compare these two items at all—the unit of cubic foot in squared timber and that from the quarter girth in round timber are not the same thing at all?—I quite realise that.

159. That seems to be a very important thing. Before you can make a fair comparison you must reduce them to similar terms?—Yes. Foreign square timber and foreign round timber are carried at similar rates, or rather not quite similar rates, but there is only a slight difference. The general classification is deals, battens, and boards, 66 cubic feet to the ton, and then sawn into planks, measurement weight. I think it might be useful to the Inquiry if we were to put in an extract relating to timber from the General Railway Classification of Goods for this year. (*Appendix IV.*)

160. Is it not the case that railway companies charge a higher rate per cubic foot, or a higher rate per nominal ton, when you take the quarter-girth measurement?—That is so; it is placed in a higher class.

161. If you take 40 or 50 cubic feet to the ton, then you have to pay a higher rate?—Yes, than in the case of deals. But it is the same measurement in the case of foreign round-timber: the same system of measurement as in the English round-timber measurement.

162. (*Sir John Rolleston.*) Do you purchase home-grown timber for general purposes?—For general local purposes; but, as I said before, the English timber trade is very much a localised trade, and one cannot speak for every branch of it.

163. But the greater part of your trade is in home-grown timber?—Yes. It is practically all home-grown timber.

164. I understood the answer that you gave in your examination by the Chairman was hardly the same that you gave to Professor Schlich as to what sort of timber you recommend landowners to plant. I understood you to say ash and oak, which, I suppose, are timbers for which you have the greatest demand?—Yes. From my own personal experience those two are the most important so far as getting a certain value per acre is concerned; because the price per cubic foot is higher. The demand in volume is not so great for the hard woods as it is in pines and firs.

165. But the supply is short, is it not?—The supply of best quality ash is short at present.

166. Is the price of ash and oak very much what it was 30 years ago?—Pretty much what it was, especially ash.

167. Scotch pine you said was half; 8d. against 16d. I think you said?—Yes, I am speaking of West Riding prices for timber delivered.

168. Therefore, in your opinion, the most paying trees for landowners to plant would be ash and oak now?—In districts where the demand is for ash and oak more particularly. I do not speak of what may be the best thing to plant, say, in Scotland, where an estuary may run far inland, with shipping facilities to perhaps some of our colliery districts in other parts of the kingdom. Possibly the best thing in that case would be to plant mining timber.

169. Props?—Yes, pit props, and to properly grow firs and pines for building timbers in anticipation of the time when our foreign supplies may be running out. But, speaking from local experience, where the land is suitable, simply because of the prices per foot being higher (I do not think the one statement really conflicts with the other), ash and oak fetch higher prices, and are more in demand at present for local purposes.

170. In Gloucester, probably, ash and oak would be the best trees to plant?—I think they would be. Of course, the Gloucestershire oak has a high reputation.

171. Do you buy hedgerow-timber?—Yes.

172. How does the quality of hedgerow-timber compare with the timber from plantations and woods?—The bole is harder, tougher, and perhaps it is not always so white; but that depends on other circumstances, and is not necessarily a defect. The top is rougher, and of less value except for some purposes. A curved top would produce a curved timber for felloes and things of that kind. Speaking broadly, where short lengths are required, hedgerow-timber is more valuable for its toughness. This I have not tested by machine or anything of that kind. Where long lengths are required, plantation ash is the best.

173. Hedgerow-timber is a favourite timber of your's, is it not?—Yes, for cart shafts.

174. The transport of hedgerow-timber is usually easy, is it not? It is grown where there are farms and roads about, and so on?—Except at certain periods, when the farmers' crops are on the ground, it is easily got at, of course.

175. A crop of hedgerow-timber is certainly worth the attention of landowners?—Certainly; and I think where trees are felled in the hedgerows for the convenience of tenants, which is very often done, it is advisable that trees should be replanted so as to follow on and take the place of those which have been felled. In consideration for the farmer, I am not quite sure that ash is the best timber for that purpose; but for the grower and the user, ash-timber is perhaps the best. A farmer will tell you that ash robs his land more than anything else.

176. It would not matter much on pasture, would it?—It would not matter so much on pasture, or, at any rate, it would not be so evident.

177. Do you supply any timber for paving purposes?—No, but I know people who do. There are paving blocks made of English oak-timber. Mr. Stenning, the Chairman of our Federation, does a large business of that kind. The blocks are made of English oak-timber, built up.

178. It is the practice of the large towns now to go to the forest instead of to the quarry for paving material?—Yes.

179. And it is becoming more usual for them to do so?—It is becoming more usual.

180. English oak-timber is a good paving material, is it not?—It is perhaps the best.

181. Is there any other English timber that will do for that purpose?—Yes. I should think elm would do, because it stands alterations of wet and dry conditions.

Mr. S. Margerison.

22 Apr. 1902.

182. Would any of the conifers do?—I do not know. I should think, myself, they are just as good for that purpose as foreign if they are creasoted, and a creasoting plant on an estate is a paying concern. With regard to creosoting, Mr. Havelock, who, I believe, is coming to give evidence, can give you some information from his own practical experience.

183. My point is that there is an enormous demand now, and likely to be a much larger demand for timber for paving purposes, and my desire was to elicit from you if there was any English timber which could be grown to supply that demand?—I do not see why the English conifer should not be really better for that purpose, although perhaps not so good for building purposes, and that sort of thing. Even English conifers grown under the present system I think may be possibly better than foreign conifers. This is a new point, and I am speaking on the spur of the moment, but still I am strongly of opinion that our harder English conifers may be better for paving blocks than foreign conifers.

184. Would there be a supply if they were proved to be of value for that purpose?—I do not know whether there would be at present a sufficient supply.

185. Did you happen to supply the gate-heads to the Manchester Ship Canal for the locks?—No; but I have supplied a large quantity of oak for railway waggon-building purposes, and one or two of the wider-awake railway companies prefer English oak to any other for sole bars.

186. I was only interested to know if you supplied the large timbers for those locks?—No, I did not. Are they English timbers?

187. Yes, English oak, and they had great difficulty in finding them?—I did not remember that. One of my customers told me that he built as an experiment—a very useful experiment—twelve railway waggons, in six of which the framework was of English oak, and in the other six the framework of foreign oak. By the time the English oak framework came in to be repaired, the foreign oak waggons were completely finished. That is a very strong point. All the twelve waggons were used at the same time for exactly the same purpose.

188. That bears out your point as to the durability of English grown oak and its toughness?—Yes.

189. (*Mr. G. Marshall.*) **On the subject of railway carriage, you have been a member of the English Federation, and you have also attended the Board of Trade Conferences, and the Clearing House Conferences, and you have had several very hard fights with the railway companies?**—We have.

190. Have you had many concessions from them so far?—We were very glad in 1893 to get back to where we were.

191. Then you got practically nothing from them?—They were putting on to us from 20 to 300 per cent., and the thing came with such a crash at the time that we were very thankful indeed to get back to where we were.

192. And since then you have had no concession?—No.

193. Competition then is the only opportunity you have of making a good rate—when two lines run from the same place?—That is the only chance; but now we cannot even get that, because the Railways' Association has so combined most of the railway companies that one company will not do anything without consulting the others.

194. The only thing that can possibly help you in the way of getting your troubles alleviated in that way would be an Act of Parliament?—That is all. As a federation we have promoted three Bills, all of which have been simply blocked.

195. You mentioned in part of your evidence that you would not recommend larch being planted closely together?—I have an idea that larch is not quite so shade-bearing as some of the other conifers.

196. It was not for any fear for the larch contracting the larch disease?—No, although, of course, that question does possibly come in.

197. You kindly gave us a comparison between the English oak and foreign oak, as used for the construction of waggon trucks. May I ask you whether the large railway companies are using much English oak now for their carriage building, or are they using foreign oak in preference?—Many of them are using foreign oak in preference because of the price, I think. But one or two of the better class railway companies see further, and are using English oak. They pay the higher price for it.

198. I know that some years ago a large quantity of the best of the oak timber grown in the South of England was bought by the North Eastern Railway Company, and they shipped it to Goole and Hull, took it on to York, and then converted it themselves. Do they still buy the same quantity of English timber?—They still buy large quantities.

199. Is that the same sort of good quality timber that they used to buy, suitable for making sole bars, long lengths?—They still want the same quality, and if anything they are making the specification more difficult to fill.

200. On the whole, you think that all the time there is good oak timber to be had, and there will be a certain demand for it in England?—Yes.

201. And that whilst people can get good English oak they will not use foreign unless they are induced to do so by the difference in the price?—Exactly.

202. That is your view?—Yes.

203. You said you had rather a difficulty in getting oak timber. Are you aware that the timber merchants in the South of England are rather overstocked this year with timber, and are, in fact, not taking the lots offered to them; in fact, there is rather a slump in timber in the south?—Did I say there was any difficulty in finding timber?

204. I think you said you had not always got as much as you wanted of the hard woods?—We have not the same quantity of large, long, hard wood, but I do not think there is yet much of a famine. We have occasional lots, but I do not think there is much of a famine.

205. Let me put the question in another way. Is oak timber selling in the North of England as well now as it was last year?—No.

206. There is a fall of price?—Yes; there is a fall of price.

207. How do you account for the sudden fall in prices? Is it because there is more timber in the market than the timber merchants can dispose of?—I think it is the old question of supply and demand. People are not buying timber so freely during the last twelve months, just as they are not buying other materials.

208. In spite of all that, you are still of opinion that if good English oak timber and good English ash timber can be grown in England, as far as you know for many years to come there will be always a good demand for it?—Yes, I believe so, judiciously felled. Sometimes there is a large quantity rushed into the market, and at other times there is scarcely any.

209. Then the theory that large quantities are better to deal with than small quantities does not hold unless judiciously felled, or if rushed on to the market?—Large quantities irregularly marketed.

210. (*Dr. Somerville.*) **I should like to get a little more information out of you for the benefit of this Committee about the railway question and rates. I suppose you agree that, other things being equal, 50 cubic feet of square timber contain the same amount of material as 40 cubic feet of round timber?**—It depends on the divisor you have used. The 144 divisor as against the 113 divisor would give different results.

211. I do not want to make it at all an intricate question, but I understand that if the timber is measured on the quarter girth system you will really get 25 per cent. more wood than is put into the figures. You get the slabs in fact in addition?—No. If the timber is absolutely cylindrical you would do that, but this is very rarely the case.

212. But even the quarter girth measurement system is supposed to take that into account. It is not measured at one end and at the other, but it is measured in the middle?—Yes, but you do not always get the trees round.

213. Still, speaking generally, without going too much into detail, is it not a fact that you get about 25 per cent. more?—No, although if the trees were cylindrical or exactly circular in section you would.

214. You have already told the Committee that if you cut up round timber you would lose from 25 to 33 per cent. in the cutting?—Yes.

215. And that 25 to 33 per cent. goes in slabs and in sawdust?—Yes.

216. Then you will not allow me to say that you agree with me generally?—No, not that the 144 divisor gives, generally, so much advantage over the square.

217. If you will not agree with me then you bring me to a stop?—I am not quite sure whether we are working on the same question.

218. May I take it in this way? You have a stick that is a cylinder; you measure that stick by the quarter girth system and make it to be 40 cubic feet. You then put it on to the saw bench and you cut it up, and you throw aside the slabs and get a square block of timber. Would not you get 40 cubic feet in that square block of timber?—If the thing was perfectly cylindrical you would get a considerable portion of it.

219. But you would get practically 40 cubic feet?—I should not like to say that.

220. You would throw aside 25 per cent. of slabs?—Say a third—33 per cent.

221. Part of it would be sawdust—say 25 per cent. of slabs, and 8 per cent. of sawdust, that is 33 per cent. Under ordinary calculations you have 25 per cent. more of wood material in round timber than is expressed in the volume?—If it be exactly round. A large proportion of our timber is fluted and irregular or oval in section, and there is consequently a reduction in cubical contents.

222. And yet in connection with railway rating you say that for round timber they take from 40 to 50 cubic feet quarter girth measurement to be a load, and 66 cubic feet if it is in the form of deals?—Yes.

223. In place of that being 25 per cent. more it is really 50 per cent. more. How do you account for this great difference? Is it not a fact that when the timber is round it not only contains the slabs, which are not taken into account, but also contains a great deal of moisture, and is wet and heavy?—Yes, so are deals when they first come in.

224. But still round timber contains more water than square?—Not necessarily. You will sometimes have timber which has been lying felled a couple of years, and it gets very dry. Pitch pine which has been laid in the timber yard in a pond is far heavier than the average of our British timber.

225. I am taking the case of the timber as it comes out of our woods, and is round, and as it is put on to our railways, and I ask, Does it not contain a great deal of moisture, and do not the railway companies take account of that in the rates?—No doubt they do, but that is not the average.

226. Why is it that more timber is not manufactured in the wood, squared, and got on to the railways at an apparently lower rate of carriage?—It is a difficult thing in the case of hard-woods, say ash and oak. It perhaps saves more to use the heavier sawing machinery in the towns which produces a finer cut. It saves the waste of sawdust, and there are also the longer lengths of timber near the customers, and that timber can be cut into suitable lengths according to special requirements. In fact it is more convenient altogether for the higher grade timbers than when you work in the open country. Again, few landowners care to have a saw mill in the middle of their estate, perhaps in the middle of their game preserves. But I believe they over-estimate the disadvantage.

227. I suppose you could burn the slabs, could not you, for the steam engine?—Yes, with a special fire-box.

228. And would not the slabs just about manufacture the wood?—I believe they would very often.

229. I suppose that the slabs would be probably as well disposed of in firing the boiler as in being taken to town, having railway carriage paid on them, and cutting them up to sell for firewood?—Yes. This would work in the case of cheap timbers, the conifers and things of that sort; but I do not think it would work quite so well with hard wood, ash and oak.

230. Do you employ steam haulage much on roads?—I do not personally.

231. Do you believe there are any advantages in it as compared with horse labour?—I am told there are; but I have had no personal experience, and I should not care to make a definite statement.

232. Do you find steam haulage by roads is common in Yorkshire?—No.

Mr. S. Margerison.

22 Apr. 1902.

233. I do not mean for timber specially, but for other forms of haulage?—It is fairly common now for bricks, stone, and that class of thing, for which steam lorries are used.

234. Do you believe that the Local Authority Regulations interfere much with steam haulage, that they schedule bridges to such an extent that the steam engines have a difficulty in getting from place to place?—Yes, I believe they do.

235. You have perhaps known instances of bridges being scheduled for a long time, and no steps being taken to put them in such a condition as to allow the engines to get over them?—I have.

236. I suppose you agree that these restrictions must limit the use of such forms of haulage?—Yes.

237. I suppose it would be possible for a local authority to keep a bridge scheduled for some years simply to keep the engines off the road?—It would be.

238. But you would not suggest that such a thing was ever done, would you?—I should not like to make a definite statement, but one cannot help wondering when one sees things in a certain state for a length of time.

239. You said that for certain purposes English hardwood was preferable to hard-wood grown in closer forests?—Yes.

240. I suppose these purposes are, on the whole, limited in extent? Timber is better if it is clean grained than if it is coarser?—Yes; a larger volume of timber is used for purposes where long, clean grained timber is required than for other purposes, where density and weight and toughness are required. Still, a large quantity of the dense timbers is wanted.

241. Supposing that English forestry underwent a process of improvement which resulted in the production of a large amount of fine timber, you would not, I suppose, suggest that certain areas should be kept open for the production of this rougher timber, but rather you would say that this rougher timber can be got in sufficient quantity from the hedgerows and from woods that are accidentally made open by wind, and so on?—Exactly, and the fringes of the wood on the windward side, especially on high ground.

242. But you would not make that a specific object of sylviculture?—No, I should not.

243. You think you would get a sufficient quantity of timber, in fact, under a natural process?—Yes. I am glad you asked that question, because I think we should by accidents and environments get quite sufficient of that class by sticking to the system which would give us long, clean lengths.

244. Do not you think that railway carriage for home-grown round timber is put higher on account of the awkward shapes that the trees often have?—That is one reason they give us, and, I think, with a certain amount of truth. I do not want to say that the whole fault of this is the fault of the railway company. I think there is a certain amount of risk in the dangerous character of the traffic. Native timber is often knotty and rough, and so on, and it makes a comparatively light and somewhat dangerous stuff for a load. On the other hand, my personal experience, and that of other people in the trade, is that even if you offer to prepare the timber in such a way that you can get loads per truck equally safe and equally large as those of imported timber, you do not get any concessions.

245. I suppose you would get the same rates, would not you, for square English timber that prevail for square foreign timber?—Between the same points we should, but not from intermediate stations. This is perhaps the essential point: We should not get the same rate per ton per mile for intermediate stations that we should from ports.

246. But I suppose, on shorter runs—and intermediate stations, of course, mean shorter runs—the terminal charges, shunting, waste of coal, and knocking about, are necessarily greater than from ports?—Yes. They put a heavy charge on for that. But, in the first place, the land for these intermediate stations is not so costly; it is considerably less than for port stations, and some of the terminal charges ought not to be so high.

247. You seem to strongly recommend the planting of ash?—Yes.

248. I suppose you find that ash varies in quality considerably in different places?—That is so.

Mr. S. Margerison.

22 Apr. 1902.

249. And that certain ash, which appears to be all right, turns out very "tender"?—Yes.

250. Do you happen to know what relationship there is between this tenderness and the situation of growth? Can you tell by looking at a tree from the outside whether it is likely to be tender or not?—I think the appearance of the bark would be usually a sufficient indication to me.

251. Are you much troubled with the occurrence of shake in trees, more particularly oak?—Yes.

252. Do you find that shake prevails a good deal?—I do. I think there is more in some districts, and on some soils, perhaps, than on others.

253. Is that the star shake?—Both the star shake and the cup shake.

254. Do you happen to have any views with regard to the origin of shake?—I am rather dubious about being positive with regard to them. I think I can say pretty certainly what accentuates them, from what I have seen.

255. What?—Frost. I have actually seen a tree, and heard it extending a crack during a frost, after a heavy rain, when the shake has had water poured into it and a sudden frost has come on. The sound of it drew my attention to it. I went to see it and could actually see the shake enlarging. But as to the beginning of the shake I should be rather dubious in answering. One would not like to give a positive opinion. It may be perhaps rapid growth at a certain period, followed by sudden contraction from cold. Perhaps thus separating the new wood from the old might have something to do with it; but I do not want to be positive on that point.

256. You found, I suppose, in your Continental trip that oak is very often grown in association with beech?—Yes.

257. You do not find that so much in this country?—No.

258. But you have taken oak trees out of beech woods, I suppose?—Yes.

259. Do you find the quality of the oak is good under such circumstances?—I think it is.

260. You would, in fact, say that if you had an oak tree of a certain volume from a wood well supplied with beeches, the probability is that that would be good?—I should.

261. Would you also say that it would be less liable to shake?—I have not noticed that. I am not quite sure from what I have seen of timber in that way that the beech would be always as good. I am speaking now from local experience. It is a case where perhaps some other factor comes in, and I have not paid special attention to it.

262. Another point I wish to ask you a question upon is as to whether you have ever come across a case in Great Britain where the purchaser of the timber was under an obligation in his contract to replant the area after deforestation?—No, I have not.

263. Do you find that rabbits do a great deal of damage?—I think rabbits are the greatest curse the forester has to contend with. Rabbits and forestry cannot go on together.

264. We all know that they destroy young trees, but as a purchaser of mature trees do you ever find the effects of rabbits persisting after the trees are 40 or 50 years old?—I do. I had a very striking instance some years ago. In fact, it was at a trial where claims were made for some hundreds of pounds for damage done by rabbits to trees which averaged over 30 cubic feet. In some cases they had eaten off the bark completely round the trees.

265. They had eaten the bark off those large trees?—Yes.

266. Supposing a tree when about two inches or three inches in diameter is rather severely barked by rabbits, and 50 or 60 years later you bought that tree, would you expect to find incipient decay at those places where it was barked by the rabbits?—Yes.

267. In other words, the effects of the rabbits are not confined to the nibbling of young trees, but the effects are to be actually witnessed 50 to 100 years afterwards in the comparatively unsound condition of the timber?—That is so, and that might be continued right through the tree, and possibly not show on the outside. I am told by those who have studied it—I am not much of an ornithologist myself, nor much of a naturalist—but I am told in many ways our keepers are too keen in destroying weasels and owls. Birds are great friends of the forest because they destroy the mice that eat the seeds of trees. Also many of our largest insectivorous birds, such as jays, magpies, and jackdaws, are destroyed when it would be wiser to protect them. Moles also consume a large quantity of the larvæ underground, and it might be advantageous in certain parts to protect them also. education would help owners and others, and points upon which, as I say, in the German forestry schools, the Continental forester is far better instructed than we are. Forest museums scattered about the country would give very useful object lessons.

268. (*Mr. J. H. Lewis.*) Are you well acquainted with the north and south of Wales?—Not well acquainted.

269. Are you sufficiently well acquainted with Wales to be able to say whether there are large areas of land which might with advantage be planted?—I am sufficiently well acquainted to be able to say that in a general way. I feel pretty sure about it. There is no doubt about it.

270. That might be profitably planted?—That might be profitably planted.

271. (*Professor Schlich.*) I am very much interested in the financial aspect of the business, because I think success or failure may turn ultimately on the question whether it will pay or not. You have been good enough to say in answer to Sir John Rolleston that you consider the growing of oak and ash the most profitable crops?—Yes.

272. What is, at the present moment, the average price per cubic foot of oak and ash?—One hears of prices such as 3s. 6d. per cubic foot in the forest for ash, and 2s. 6d. for oak, and perhaps more. But these are exceptional and local prices, and 1s. to 1s. 6d. are more usual.

273. I am not particular about a few pence. You say ash will fetch more than oak?—It depends upon the local demand.

274. Would you say that ash would certainly fetch as much as oak?—Yes, I think it would to-day; generally quite as much.

275. I am not particular as to a few pence?—It depends upon the local demand.

276. Taking it all round, you think that ash might fetch at least the same price as oak?—Yes.

277. At what age do you consider ash would mature?—Generally speaking at about 80 years.

278. At what age do you consider oak would mature?—At 120 to 160 years.

279. Would there be much difference in the number of cubic feet per acre that you would get from the one or from the other?—That is rather a difficult question to answer.

280. Would there be a decided difference?—I do not think there would be a decided difference; it would depend upon the suitability of the soil to the tree, and of the tree to the soil—on the environments generally.

281. If you got the same price per cubic foot, or if anything a little more for ash, and if there is no decided difference between the number of cubic feet, and if you harvest one at 80 years and the other at, say, 140 years, why do you throw the two together as regards the financial results? Do you not think that the one is about five times as profitable as the other?—It would be much more if the prices kept the same; but so many changes occur in the period covered by the life of a tree, and English oak, speaking broadly, seems to be getting very much less common than it used to be. I think the price of English oak may be higher in 80 or 150 years. I do not, however, care to prophesy to such an extent. It is yearly being more and more used in high-class architecture, and is still much used for many purposes.

282. Do you admit that ash would be eminently more profitable than oak?—Yes, under present circumstances. I think I said that for the most profitable timber, where the soil was suitable, ash was the thing to plant.

283. You think that ash and oak together are profitable crops?—Yes. I do not mean necessarily planted in the same woods.

Mr. S. Margerison.

22 Apr. 1902.

284. With regard to pit props—you would agree to cut them at the age of 40 or 45 years?—Yes.

285. And even if you got a smaller amount per cubic foot at 40 years you would get more cubic feet in twice 40 years than you would get in an ash crop in 80 years. Do you think that pit crops might be just as profitable as ash, and certainly more profitable than oak?—It depends upon the local conditions. If the soil is more suitable for growing ash you would get a very profitable crop from ash.

286. We will assume that the soil in each case is the most profitable for each species?—In that case I should prefer ash

287. By "most profitable" I mean in one case most profitable for ash and in the other case most profitable for oak under the best conditions. We ought to be a little careful in making statements like that, that oak and ash are the most profitable things to grow. What I am trying to get out is that it depends absolutely and entirely on the special conditions you have to deal with in each case?—Yes.

288. And you agree that certainly you ought not to throw ash and oak together?—This is the essential point of it. You have a certain cost of transport on timber, whether it be conifers or hard wood. The price of the hard woods delivered is considerably higher than that of coniferous timbers, so that, the cost of transport being the same, it does not make such a big proportionate deduction from the value of the hard woods on the ground as it does in the case of the lower-priced timbers; and in the case of the coniferous timbers it is as much as 90 per cent., and leaves you practically nothing for growing.

289. The difference between conifers and ash would not be so great as the difference between ash and oak?—No.

290. Therefore, I say we must not put the two together?—I think I said before that I consider ash the most profitable to grow.

291. And oak probably not one-fifth or one-sixth as profitable as ash because it takes such a long time to mature?—Yes, it does take a long time to grow.

292. With regard to shake, have you had any experience whether shake in oak occurs more frequently in open woods than it does in dense woods?—I should not like to make a definite statement with regard to that. I have noticed that a band through a wood may be slightly raised or even slightly hollow, and will often contain more shaken trees than on either side. I have seen it in the case of a slightly raised part, and I have seen it in the case of a slightly lowered part.

293. On the slightly raised part it would be more?—Yes. It would be more. I have seen a band of shaken trees going through a wood for some considerable distance, and on each side it would be comparatively free. I should very much like to know more about the origin of shake.

294. You said you had had a little experience some time ago, where trees of 30 or even more cubic feet had been barked by rabbits?—Yes.

295. What kind of trees were those?—Ash.

296. (*Sir John Rolleston.*) You appear to have given some attention to ornithology. Can you tell me what effect starlings have in large numbers upon conifers?—No. Personally I have not paid very much attention to ornithology.

297. It is the habit of starlings to flock in some places, especially in small conifers of some 14 or 15 years' growth, and they completely fill the place: you do not know whether they are injurious or not?—No.

298. But you think all the birds of the air are good for forests?—Yes, they are, generally speaking.

299. They are usually all killed down except one sort?—When one sees a flock of rooks in hundreds destroying the oak moth caterpillars, one cannot help feeling that it would be disastrous to kill off those birds.

300. And weasels, and stoats, and moles ought to be preserved by the forester?—Yes.

301. On account of the mice they destroy?—Yes. One thing that foresters and owners ought to keep ever before them is that they should use the rough common timber for estate work and send the better timbers to market. I have no doubt from things I saw in Germany that the good quality of our imported foreign oak is due to selection. I saw shaken oaks in Germany, and oaks with other defects which possibly might not be sent into foreign markets. I do not know whether the Germans in that particular district do send much of any kind away, but it is important that the rougher timber such as can be used for fences and other estate purposes in this country should be used on the spot in order to keep the foreign timber bill down. Then there is the question of "extraordinary traffic." In some districts we find that a considerable amount of worry and harass has been caused to the home timber merchants owing to charges being made and proceedings being taken in order to draw damages for "extraordinary traffic." Our Federation has taken up a certain position in the matter which I should like to mention. Here is the report of our Federation for the year 1898, in which it is stated: "Complaints continue to be received from time to time as to claims by the local authorities in respect to damage to the roads by alleged extraordinary traffic in native timber, but the Section"—that is the English Timber Section—"has always advised its members to adhere to the contention that has been successfully maintained in previous years, viz., that native timber growing is a natural industry in certain districts, and therefore not liable to contribute more than the agricultural traffic to the expenses of maintaining the roads." I hold also that for a long period plantations pay rates for which they have no advantage, and that it is very hard when the time comes and the crop is realised that demands of this sort should be sprung upon them; in fact, we have found those demands if faced were not proceeded with. Still, there are cases where men have given in, and it has been a serious handicap to the trade.

302. (*Professor Schlich.*) There was a severe case in Wales the other day in which heavy sums of money had to be paid which practically came to as much as the timber was worth?—We had the same thing in Yorkshire. In cases, however, where the Federation has taken the matter up, notwithstanding the magistrate's decision, an appeal has been made and the thing has been quashed, the District Council having to pay not only the whole of the costs, but the costs incurred in the preparation of the magistrate's case.

303. (*Chairman.*) Do you try to meet the objections of urban authorities by having broader wheels for heavy loads?—That is so, and I believe in the trade generally broader wheels are used than in other traffic. Timber merchants, as far as my experience goes, do everything reasonable in a case of that kind.

304. (*Mr. Marshall.*) In the old turnpike times, timber carriages on wider wheels were allowed at a lower rate than timber carriages with narrow wheels?—I think so, and that was quite reasonable. Generally speaking, the question of transport is the most important thing for growers of timber to consider in connection with their forestry.

305. (*Chairman.*) I should like to ask one question with regard to transport. Do you think that other timber merchants like yourself have not done much work yet with traction haulage?—One hears of cases, but I have not had much conversation with anyone who has done it.

306. It is not common in England?—I do not think it is common.

307. On the other hand, the saw-pit is still used here, is it not?—Occasionally. Personally, I have saw-pits for certain work, cutting out boat timbers. I have a barge-building yard, and we find it is economical in cutting out long curved timbers to use the saw-pit.

308. Do you think that the traction engine with cars, and the travelling saw bench, and all the available apparatus for cutting up which can be sent along a road wherever you want it to go, is quite possibly a system from the extension of which you might expect certain advantages?—I think it is possible. With regard to Government assistance in the way of planting, in Germany loans are granted. There are other witnesses who may be able to speak more on that subject than I can, but there they are developing waste lands by Government loans at a low rate of interest, with Government supervision.

309. Would you require to have a Government gamekeeper also?—It is quite possible.

Mr. S. Margerison.

22 Apr. 1902.

310. It would want official supervision, would it not?—Yes, and working plans with very strict supervision. The supervision is perhaps of more importance than the grant. I am speaking of a thing among experts, but there is no doubt about it that a system of that kind, with Government supervision—something that cannot be altered—is one of the things we really ought to aim at.

Mr. C. Hopton.

Mr. CHARLES HOPTON, called; and Examined.

311. (*Chairman.*) I believe you are Vice-President of the Timber Trades Federation?—Yes.

312. And I think you wish to supplement Mr. Margerison's evidence on one or two points?—Yes, with regard to the rebate on foreign exports. It is the custom of the French and Belgian railways, to my knowledge, to give preferential rates for all exports. I found that there were certain rates for timber to the different ports, but if that self-same timber was to be exported, then there was a rebate on those rates given to the exporter. Of course, that is a different system from that which obtains here. Abroad they foster home products, whereas on this side we seem to penalise our home product by the railways charging higher rates. That was the only point, I think, upon which Mr. Margerison did not speak.

313. (*Mr Lewis.*) What inducement is there to the railway companies to give preferential rates? Does the Belgian Government assist the railway companies?—Some of the railways are Government railways, and assistance is given.

314. Do you know whether on railways which are not Government railways the same system of giving preferential rates to exporters prevails?—Yes, the system prevails.

315. In that case do they receive any support from the Government?—So far as the Government is concerned I do not know that they receive actual support. What I am referring to is the fact that they have lower rates for the same produce. For instance, take a rate in Belgium going from the interior to Antwerp. The rate may be 15 francs a ton to Antwerp; but upon a declaration being signed by the sender that the goods, or timber, or whatever it may be, are for export, he gets a rebate upon that rate of, say, 5 francs a ton.

316. It would appear that in regard to Government railways it is within the power of the Government to encourage export; but is that the case with reference to privately-owned railways? Is it in consequence of any encouragement that they receive from the Government that they charge preferential rates?—That I am not able to tell you. Instances have come under my notice where they had a rebate from the railway company; but whether they obtained money from the Government or not, I am not sure; but no doubt the Committee will be able to get that information.

317. You appreciate my point, and possibly you may be able to obtain that information for us?—I think the Committee could easily get the information from one of the State railways. If the Committee makes an inquiry from any of the ports whether there are any rebates on the rates for exports, it will be found that what I have said is correct. I think what I have said holds good with regard to all the French and Belgian railways. You can easily obtain that information for yourselves. You can soon find out whether it applies to both private and Government railways.

318. (*Professor Schlich.*) Have you ever received any timber from Belgium?—Yes.

319. That is worked-up timber, is it not, and not in the rough?—In the rough.

320. Timber from Belgium?—Yes, beech. Mr. Margerison has spoken of beech. We have received beech from some Belgian ports.

321. I am surprised at that statement. I have been in Belgium myself, and I know that Belgium imports timber in about the same proportion as Great Britain and Ireland. The imports of timber into Belgium amount to over one hundred million francs a year, and I should have hardly thought it was worth while for the Belgian Government to encourage export?—It is, however, a fact, and I can give you the names of the estates if you like, one of which belongs to Prince d'Aremberg.

322. (*Dr. Somerville.*) I think you said when Mr. Margerison was being examined, that beech butts were sold for piano making?—Yes, for wrest-planks.

323. But the case of the piano would be made of something else, would it not?—The cases are made out of all sorts of wood.

324. Chiefly spruce?—No, chiefly from white wood from America, which is veneered, or from mahogany. A large quantity of American white wood is used for that purpose now.

325. (*Mr. Marshall.*) Are you a timber merchant yourself?—Yes, I am.

326. Do you go in for ash?—Yes, a great deal.

327. Bent ash?—Yes. I go in for ash for bending a good deal. I may anticipate your question, and say that English ash is about the only ash that will bend.

328. Do you travel much, and go all over England to get your supplies of timber?—Yes. I find that the supply diminishes year by year, and that we have to go further afield. Unfortunately, however, the railway rates are so high that we are obliged to use foreign timber in the place of British timber. Previously, of course, we used British timber.

329. With regard to the quality. I suppose you will not admit that the American ash is anything like as good in quality as English?—It is not at all suitable for bending purposes. The only use American ash can be put to is where it can be used in straight form; but where curves are used no other ash will take the place of English.

330. When going about the country buying timber, do you see much young ash coming along?—Very little.

331. (*Chairman.*) Is there any other point you would like to mention?—I do not think so. The points which Mr. Margerison has brought before the Committee concern forestry more than anything else. The Federation can give you any amount of information as to the comparison of railway rates, English and foreign; I do not know whether that concerns the Committee. A great deal of stress appears to have been laid upon that question by one or two of the members; but, generally speaking I may state that the rates for English grown timber, as compared with foreign, are in some cases from 30 to 60 per cent. more, even taking into consideration its better form.

Colonel F. Bailey, R.E.

Colonel FREDERICK BAILEY, R.E., Member of the Committee; Examined.

332. (*Chairman.*) I believe you have had great experience in the Forest Department in India and at Nancy before occupying your present position at Edinburgh University?—Yes.

333. Also in English, French, and Hungarian forestry; you are editor of the Transactions of the Royal Scottish Arboricultural Society, and you have had practical experience in surveying management under the British system?—Yes, that is so.

334. I believe you wish to make a statement to the Committee, and that I think will be the most convenient form of taking your evidence?—I may, perhaps, mention in connection with my experience in this matter that for 31 years I have been engaged in forestry business, the last 20 years of which have been spent in forest education. I have spent seven years of that time as director of the Indian forest school, three years at the forest school in Nancy, where I was in charge of the British students; but took the opportunity of passing myself through the courses. For the last ten years I have been lecturing on forestry in Edinburgh. That makes a total experience of 20 years in forestry education. I have also travelled a great deal and inspected forests in many parts of Europe, including most of France, a considerable portion of Germany, Hungary, and other parts of the Continent. I have also seen forests in Canada, and, to some extent, those in Cape Colony. I have published reports on the forests of France and of Hungary, and have framed working plans for two estates in Scotland.

Colonel F. Bailey, R.E.

22 Apr. 1902.

335. Perhaps you will be good enough to read to us your statement?—I have drawn up this memorandum with the object of saving time, and I shall be glad to answer any questions which may arise upon it.

The conviction is gaining ground amongst Scottish wood-managers that the results of the old sylvicultural methods are unsatisfactory, and that these methods are not the best that could be employed; there is a strong desire for instruction in the systems of sylviculture that are successfully practised in other countries.

CONDITION OF WOODS IN SCOTLAND.

The younger woods are for the most part growing up too thinly stocked, and often show considerable blanks, due to failure to make good death vacancies in the early stages. The sylvicultural methods now commonly practised here do not result in the production of a remunerative class of timber, and this is especially so in the case of conifers. The condition in which most of our woods are allowed to remain, and which appears to be mainly due to faulty selection of species, injudicious mixtures, damage by game, failure to fill up vacancies in early youth, over-thinning, especially in youth, and the practice of thinning out from time to time the best poles to supply orders, prevents their yielding a reasonable profit to their owners. See the Raith Working Plan (p. 11), which describes the condition of the older woods on that estate. It runs as follows: "Speaking generally, the younger woods up to the age of sixteen years, which cover an area of 573¼ acres, are fairly well stocked and in good condition; but the same cannot be said of the older woods (235¼ acres), which bear very thin and irregularly distributed crops of inferior quality. In consequence, without doubt, of too early isolation, the trees composing these thin crops are deficient in height and taper rapidly from the butt; while, owing to the unrestricted development of side branches, their timber is knotty; and, as they were given excessive growing space in their youth, they then formed unduly wide annual rings, composed mainly of soft tissue. To frame a reliable estimate of the growing stock in these irregular woods it would have been necessary to undertake an innumeration survey over their entire area, but circumstances did not appear to warrant this. Such a survey was, however, made of three plots, which were selected as being the best of their kind, and the following was the result:—1. One acre of mixed spruce (two-thirds) and Scots firs (one-third) in Bankhead, average age 50 years, contained 359 trees, yielding by quarter girth measurement, 2,455 cubic feet. 2. A similarly constituted crop of half an acre in Bairnsbridge, average age 58 years, contained at the rate of 382 trees, measuring 3,114 cubic feet to the acre. 3. An acre of mixed Scots fir (¾) and spruce (¼) in Bairnsbridge, average age 58 years, carried 387 trees, measuring 2,844 cubic feet. The above figures may be said to represent something like one-half of a full stock; and it is probable that the older woods, taken together, do not, on the average, contain more than from one-quarter to one-third of the timber that might be growing on them. From the above facts it is evident that these woods are not now yielding to their owner anything like the annual increment, or annual growth of new wood, which he might reasonably expect to receive from the soil on which they stand, and also that the quality of the wood produced is inferior." Woods in this condition do not yield produce that can compete with the timber to be seen in the yards of importing timber merchants, which is for the most part grown in dense woods, and the stems are thus long, straight, cylindrical, even grained, and free of knots. The timber of openly-grown hard woods of some species is no doubt more durable and more suitable for some uses; but such crops do not usually pay, and much timber of that class will always be produced in game coverts, ornamental woods and hedgerows, etc. The fact is that our woods are, generally speaking, grown and maintained rather as game preserves and for the sake of amenity than for profit on timber. And these objects will no doubt continue to prevail over large areas, though portions of most considerable wooded estates might, and probably would, be devoted to profit earning, were the proprietors convinced that they would yield a profit; and in such portions sylvicultural considerations would necessarily guide the management.

RESULT OF IRREGULARITY IN WORKING.

Irregular, haphazard working also acts very prejudicially, preventing as it does a regular out-turn of produce of even quality. The Postmaster-General has stated that he goes to foreign markets for his telegraph posts because he cannot secure a regular supply of suitable material in this country. The agent of certain Colonial railways recently, in search of sleepers, and who considered Scotch-grown pine better for his purpose than Baltic wood, was only able to secure in Scotland 5,000 out of the 100,000 sleepers that he required. All profit-earning woods should be managed under a settled plan, in the absence of which both time and money are wasted, and steady markets with fair prices cannot be secured; while at the same time it is impossible to organise labour-saving mechanical appliances, such as tramways, slides, shoots, etc., for extracting the timber from the woods. The cost of felling and moving a few trees taken here and there on an estate is always excessive, and the expense of fencing numerous small plots of ground lays an unbearable burden on land so protected. The interest taken by the owner in properly organised woods is likely to be much greater than if they are worked irregularly.

FINANCIAL RESULTS HITHERTO ATTAINED.

If the financial results of growing woods are not now satisfactory, this is because the recognised system of management here in vogue has been faulty, and in most cases its errors have been intensified owing to sporting and æsthetic exigencies, so that the production of a profitable crop of timber has not been the only, or indeed the main, object of management. Figures resulting from such management have little or no value as a guide to what the financial results of an improved system might be. Figures relating to farms or mines exploited for purposes other than profit would not be accepted as conclusive evidence that farming and mining are unremunerative industries; and no reliance could be placed on the results obtained from a factory which required 100 able-bodied workers if the staff were reduced to 25 inefficient men, who, for my present purpose, may be taken to represent a quarter crop of ill-shaped trees growing on the ground, because these trees are the actual producers and manufacturers of wood, each tree adding a certain proportion of wood under its own bark every year. Another source of failure to realise profits is no doubt the practice, which is justified from some points of view, of leaving ground fallow for several years after it has been bared of trees. I know several estates on which the planting up of ground that has been bared of crops is many years in arrear, so that the amount of growing timber upon the ground just now is nothing like what it was, say, a dozen years ago. The revenue received from this unstocked ground is practically nothing. Our woods can produce good timber. There is no doubt whatever that under improved management we can produce just as good timber as that which we import, and that the growing of timber can here be made profitable. The general lowering of rates of interest on good securities has in this respect placed woods in a better position than they formerly occupied. It is said that our soil and climate are unsuited to the growing of woods; but this is not the opinion of the foreign experts who visited us. In their opinion our soil and climate are very favourable, and the magnificent isolated trees to be seen in parks and on roadsides prove this. No one appears to have explained what the defects of our soil and climate are; it has, however, been said that we have too little sunshine, though we probably have quite as much as is enjoyed in Norway, Sweden, Finland, and the Southern and Eastern shores of the Baltic, whence much of our imported timber comes. Here we have, unfortunately, no great State forests such as exist in Germany, France, and other countries to act as object lessons and to demonstrate the results of scientific management. We have indeed no woods that have been managed on correct lines during a period sufficiently long to show the results of such management, and we have come to believe that our woods, which are too often only half stocked with trees of rough quality, cannot produce anything better.

MODEL FORESTS REQUIRED.

We urgently require two or three model forests of limited area to be owned and managed by the State—I emphasise the use of the word State—privately owned woods are unsuited to the purpose. The objects for which these forests are required may be thus briefly stated:—

(1) As a field of practical instruction for students. Lectures without practical instruction in properly managed woods are of comparatively little use, for it is impossible to convey correct ideas regarding many of

Colonel F. Bailey, R.E.

22 Apr. 1902.

the most important sylvicultural processes by words and diagrams alone.

(2) To prove the results of rational methods of management in crops grown on our soil and in our climate, and to act as object lessons in sylviculture and systematic management to land owners and foresters throughout the country.

(3) To carry out investigations and experiments which cannot be undertaken on private estates, and to provide reliable data regarding the growing of woods for profit in this country. At the present time we have Dr. Schlich's admirable manual. Of course, his figures are all drawn from other countries, and what we would like to see in the course of time would be a set of similar figures drawn from woods grown on our own soil, and in our own climate.

Until the State sets the example, nothing effectual will be done by the majority of private owners; and existing doubts as to the capacity of our country to grow high class timber in paying quantities will not be allayed. The State need not be asked to grant away the sum required to purchase the model areas. It would retain ownership and receive the revenues.

With regard to the course of forestry given at the University of Edinburgh, this course has been maintained continuously for the past twelve years. It has done much to arouse interest in the subject, and to spread rational notions regarding it. The course was attended during the past Session, 1901-2, by nine students; the number during the preceding Session was ten. Excluding the Session of 1891-2, when fees were not charged and forty students attended, the total number of students during the past ten years has been 76, the yearly average having been 7·6. During the past Session the work of the class was arranged as follows:—

Class-room work.	*Meetings.*
Introductory lecture - - - - - -	1
Principles of Sylviculture (Text Book, Dr. Schlich's, Vol. 1) - - - - -	17
Formation and Tending of Woods (Text Book, Dr. Schlich's, Vol. 2)- - -	25
Protection against injuries- - - -	19
Structure, defects, and physical properties of timber - - - - - - -	7
Utilisation of produce- - - - - -	12
Forest management - - - - - -	7
Uses and effects of forests - - - - -	3

That makes 91 class-room lectures. Then I have held three examinations and taken eight excursions occupying 18 hours of actual work in the field without counting going and coming. The excursions to woods and nurseries were 5, and to timber yards, etc., 3, the total being 8; which means that the class met 102 times. It is urgently necessary to provide one or more small State model forests in connection with this class, as well as for the other reasons stated above; and it is also most desirable that, in addition to the model forests, which must unavoidably lie at some distance from Edinburgh, a forest-garden should be provided in the immediate vicinity of the town. Instruction to young working foresters would be provided by employing them in the woods, and by lectures given to them there. In most cases they would be unable to attend the university class. The salaries paid to foresters are now low, but they would certainly improve were a commencement made to manage woods on business lines with a view to profit. The claims of Scotland in the matter of model State forests are undeniable, not only on account of the educational efforts she has made in the past, but in view of the large area of her existing woodlands, and the number of persons actually engaged in forest work, as well as of the vast extent of her waste lands which await afforestation.

LECTURES FOR THE ABERDEENSHIRE COUNTY COUNCIL.

The experiment has just been tried of giving a short course of four lectures, arranged by the County Committee on Secondary Education. The lectures were delivered in the schoolhouse at Torphins, and there was an average attendance of from 40 to 60 persons. It is, of course, difficult in a country district to secure the attendance of the people to whom instruction in forestry would be most valuable; and this difficulty would be enhanced were the course extended to a really useful length. Such short series of lectures, however, do good by arousing an interest in the subject, and by inducing persons who, as owners or foresters, are engaged in the management of woods to seek further instruction.

EXTENSION OF THE WOODED AREA.

Vast areas of waste land in Scotland might be planted, without including ground in excessively exposed situations, or where the soil is very shallow or dry. Conifers will grow on soil which is very poor. The most important extensions might be anticipated in the Highlands, where they would have an important influence on the rural labour question. Every 1,000 acres of added forest would provide work for about 16 men, representing a population of 80 persons, without taking account of those employed in the transport of produce, and in the various industries which regularly managed woodlands generally give rise to. Apart from their value as producers of timber, woods have great value as providing shelter for farm crops and stock; and, when grown on water-gathering areas, in securing the water supply of towns.

TIMBER SUPPLY FROM ABROAD.

Mr. John Mitchell, Timber Merchant, Leith, recently showed in his yard a batch of American logs which arrived at the port of shipment by rail. They had been cut to suit the length of the trucks. He said that this was the first batch he had seen which had been so conveyed. This tends to show that the forests conveniently situated for water transport are, in some localities at any rate, becoming exhausted, and that ground more remotely situated is beginning to be drawn upon. Mr. Mitchell said that 30 years ago his firm got from abroad, without difficulty, anything they wanted; 20 years ago even they could do this, though the prices paid were then considerably higher, but now the old class of timber cannot be got even at double the old rates.

336. We are very much obliged to you for your statement. You feel that there is a general opinion amongst all classes connected with forestry in favour of a better system of training?—When I first came to Edinburgh about ten years ago there was a good deal of prejudice felt about this matter. The foresters were sensitive at the suggestion being made that it was possible to do anything better than they were doing; but I have certainly found that with the lapse of time that feeling has almost entirely, or perhaps entirely, given way, and now I am quite sure I am correct in saying that there is a general feeling of acquiescence in the views I have stated in regard to the inadequacy and insufficiency of the present system, and also a great desire on the part of a large number of men—and it is not confined to the youngest men—to learn something more. I know several working foresters who are most anxious to learn, men who have been 20 or 30 years at their business.

337. I believe some of the leading foresters in Scotland have always felt the want of some provision for training?—Yes.

338. I remember the Select Committee of 1887 when Mr. Macgregor was examined. He was asked by Dr. Farquharson whether he would have done better if he had had a course of scientific instruction, and he replied that he had not the slightest doubt of it, and that he had felt the want of it all his life; and that I think has been the feeling of the more intelligent foresters?—Yes; it is now definitely centred on a desire to learn what are generally called "continental" methods.

339. You think that two or three State forests under separate executive officers are required?—Yes, I think so.

340. But supposing we had to begin with one, is there any particular centre you would suggest?—Do you mean one for the whole of Great Britain?

341. Yes, to begin with?—I feel great interest of course in Edinburgh.

342. I mean one State forest in connection with a central system of forestry education. In the questions and answers that passed between a witness and the Committee this morning some distinction was drawn between centralising the higher form of forestry instruction and de-centralising the instruction for the working foresters. My question is: Supposing that the State undertook to create one State forest in connection with some centre of forestry instruction, either a forest school or a university, your answer would be as you have given it?—That is what I think. I consider Edinburgh is a very suitable place, because there is such a large amount of woodland in Scotland; it is nearer to

woods, and to woods of more varied character than any other centre of instruction could be. With regard to the question you have mentioned, of carrying on instruction at some centre, which might be a University or a separate forest school, that is a very big matter. If you are going to have a separate forest school for the higher education of foresters, you will require a very large equipment for the purpose of carrying that on. I speak from recollection, but I think I have given Mr. Hooker some figures from Nancy where there are something like 14 or 15 professors, and in most forest schools they have a very large number of them when they teach the whole thing from the beginning, including what we call the auxiliary sciences, such as chemistry, botany, geology, and so forth. These are all taught by special professors at the large forest schools. But if you can go to a university where professorships already exist in these subjects, and where the students can avail themselves, at least to some extent, of the existing instruction, that makes things easier. It must be fully admitted at the same time that the instruction they get from such professors is not necessarily chosen in their particular interest. I mean if you have a separate forest school you teach forest botany instead of general botany, and so with all the other sciences; there is no special direction towards the subject of forestry given in the general classes at a university. That is a matter of course, and is evidently a drawback. Still, I think I have never seen my way in the existing condition of things, with the badly paid places which are available at present for foresters, to propose that a separate forest school should be started. I believe we should have to begin, in the beginning at any rate, with organising instruction in forestry at some existing institution, some university, in fact.

343. One forest school would serve as a centre for practical instruction for more than one University or set of classes?—Yes, one area.

344. One area of State forest would serve for several centres of instruction?—It would depend upon where it was placed, of course, and what the distances were. With regard to one area or more it would, of course, be very desirable to have model areas on different classes of land. For instance, you have the high-level grounds of the Highlands for conifers and the low-level grounds for the growing of hard woods, such as oaks, ashes, or so forth. You would not grow these all in the same place, and for that reason alone you require to have more than one area.

345. There is a distinction between a State forest and the forest garden?—Yes, that is quite a different thing.

346. You would have to have a forest garden attached to each centre of theoretical instruction?—That is so. You want a forest garden. It is simply a garden of young plants which could be kept only for a few years, except perhaps a few isolated trees which might be allowed to grow up; but you could never have all sylvicultural operations illustrated; it would be impossible to do that in a forest garden.

347. A forest garden would include experiments showing the results of different methods of planting?—It would, but most of such work could be very much better done in the forest.

348. The point I wish to make clear is that supposing the State were to begin by creating one State forest, would it be possible, by having forest gardens attached to different centres of instruction, to carry on your experimental work in connection with the different University classes, with at the same time a State forest which would be valuable for all those different centres?—Experiments could be carried on only to a limited extent in anything which might be called a forest garden.

349. You attach more importance to the higher education of the agents and head foresters and landowners than you do to that of the working foresters?—In the first instance it appears to me that what you want to do certainly is to educate the landowner and the agent, because if you educate the forester ever so highly, the landowner holds the purse-strings and has absolute power in the matter, and perhaps will not do anything. The forester can then do nothing, be he ever so well-trained; but when once the master is convinced of the desirability of doing the thing, and sees how it ought to be done, then perhaps he will begin to do it. If you put the highly-trained forester under a proprietor who knows nothing about the business, it is not likely that he would do any good.

Colonel F. Bailey, R.E.
22 Apr. 1902.

350. You cited the opinions of eminent foreign authorities, such as M. Boppe, Herr Schwappach, and others in the paper which you wrote for the Royal Scottish Arboricultural Society which was presented to Mr. Long?—That paper contains some allusions to their opinions.

351. With which, of course, you concur?—Yes.

352. In it I see you give the waste land, and according to your figures the total area of mountain and heathland used for grazing is 12½ million acres, nearly 9½ millions being in Scotland?—I took those figures from the agricultural returns.

353. You go on to say in your paper, "While out of a total additional area of nearly 9 millions of acres of unused waste land and inland water, about 4½ millions are situated in Scotland." Your opinion is that some substantial proportion of this area might be profitably utilised for timber?—Yes.

354. Do estimates vary considerably as to the amount which might be so used?—I think if you really wanted to determine how much land might possibly be afforested a special investigation would have to be made.

355. That is what you desire?—Certainly.

356. A small Commission which would have to report definitely?—Yes; I think that is the only way—a special inquiry. Much depends, you see, on the elevation of the ground, the nature of the soil, and so forth, and that could not be ascertained by simply looking at maps and marking off blank areas.

357. With regard to the state of the existing woods, you quote M. Boppe as having stated that it was "a matter of regret that amongst all the forests visited by us in our travels there is not a single one suitable for the teaching of sylviculture on that broad basis so essential when the pupils are called upon to apply it in all quarters of the globe." That is your own opinion?—That is my own opinion. I have never seen one that is now fitted for the purpose of instruction. With regard to that point, I wish to emphasise the impossibility of giving efficient instruction in a subject like forestry, which I think exceeds all other subjects I am acquainted with in this connection—that is to say, it requires practical training work more than almost any other science. You may teach some sciences by bringing objects to the lecture table or handing them round amongst the students; but the things you want to show to a class of young foresters cannot be possibly so dealt with. What you want is crops of trees; you cannot bring them to the students ,you have to take the students to the trees. You therefore require a practical training ground to which students can be taken. In India there is a State school at Dehra Dun, of which I was the first Director. We had an excellent system of training, which we gave during the rainy season for three months by lectures in the house, when it was difficult or next door to impossible to go out into the woods. During the other portion of the year, about eight or nine months, we gave the lectures actually in the woods. We made sheds, or pitched tents, and the instructors, lecturers, or professors gave lectures to the men actually in the woods, and then they went and looked at the crops of trees. Or they went into the woods first, and came home and heard a lecture. That is the way to teach forestry, in my opinion. To attempt to teach it as I have been trying to in Edinburgh for the last ten years, by giving lectures and going out as often as we could to woods which have not been managed in the manner one has taught the class to manage woods, is a very inefficient way of teaching forestry. I do not say it does no good; I think it does good. I think the lectures given in Edinburgh since they were started by Dr. Somerville twelve years ago have had a very considerable effect. I believe that the 76 men who have passed through my hands and the men who passed through his hands—perhaps 100 men altogether—have sown correct ideas throughout the country, and have had a very considerable influence in modifying the prejudice that existed some years ago in regard to all methods that were not Scotch.

358. I suppose not only for the development of the resources of the mother country, but for the proper administration of our dependencies, and for the proper education of colonists, there is need to have a thorough system of forestry instruction?—I think so; not only for this country, but for the Empire generally.

359. With regard to my question as to one forest centre, Dr. Schlich says (you quote him in your article on forest education): "In my opinion you would do better if you were to start and concentrate operations

Colonel F. Bailey, R.E.

22 Apr. 1902.

so as to make one definite scheme a reality"?—Yes. At that time there was some talk of having lectures in various centres. It was proposed to have lectures, I think in Glasgow, in Aberdeen, and other places. We had not the organisation for them, and if we had attempted to do that we should have certainly failed. It was evidently a better policy to start with one scheme, made as good as it could be, and then if others arose as offshoots from it a very good result might be obtained; but it is certainly a great mistake to begin with scattered efforts.

360. Dr. Schlich also states: "There being no State forest in Scotland, I think the Government would not go out of its way if they were to buy an estate, a considerable portion of which is already under wood, and to affiliate it with the forest school at the University of Edinburgh with a duly qualified wood manager in residence on the spot." I suppose that is the scheme you support?—Yes, that is the scheme. Such a forest as that would form, as I stated in my memorandum, a training ground for a working foresters' class, the students of which would come there to practise and work with their hands in the woods under the direction of a skilled superintendent. Also at certain times or seasons, or certain days of the week, or however it might be arranged, they would get lectures on the theory of the business.

361. You say that the model forests would presumably be under the Board of Agriculture?—Yes, that is what I propose.

362. In your own scheme you provide for the acquisition of the land and trees required for conversion into a model forest 1,500 to 2,000 acres of suitable land within reach of Edinburgh, and including some 500 acres of growing woods averaging 40 years of age, and you estimate that that would not exceed in cost £40,000?—Yes.

363. You consider that the net annual income from such an estate would not be less than £1,000, and might be as high as £1,500; and this with an annual grant of £500 from Government you say should be sufficient to meet all the charges of maintenance? That is the scheme which you suggested?—Yes. Of course, it stands to reason that if you take over an estate, such as it would be possible for the Government to acquire, an estate which has been over-worked for example, as a great many of the estates have been, it would not be possible to get from it at once the full revenue that time would yield. There must be a period during which there might be very small revenues from it. That is the reason why certain financial aid might be required in the beginning, which would not be required later on. On most estates, owing to the irregularity with which successive owners planted, the stock is not anything like complete. Taking them as they now stand, and working out the number of trees with the various age classes, it is generally found that there is a very long blank, because the proprietors at a certain period did not plant anything. If you took over an estate so constituted, there must be a time during which the revenue would be small, but as soon as the estate became thoroughly well-managed and fully stocked, you would get a regular and ample revenue from it, I think.

364. With regard to the area of waste land, you think a considerable proportion of it might be afforested. I suppose you have no doubt that, to a considerable extent, afforestation would be a profitable undertaking?—I have no doubt about it.

365. Mr. Grant Thomson, in his evidence before the Select Committee in 1887, calculated that the plantations under his management would yield from about 7s. 6d. to 10s. a year per acre. That is in Strathspey. You believe there is a considerable amount of such land which might be expected to yield a return?—Yes, but there is plenty of land such as that now yielding a very small revenue to the proprietor. About a week ago I was in Aberdeenshire, and I went round some parts of an estate with its owner. We went over a good deal of ground which he is now planting, and which he told me was only yielding him 1s. an acre all round, and such ground is quite suitable for planting.

366. But from the want of any system of proper book-keeping for woods, and any accurate record, it is very difficult to tell exactly how timber is paying and has paid?—Yes, it is almost impossible. As I have said, even supposing there were complete figures, I should not think them of very great value, because the system of management has been bad. They would not influence me one bit in forming an opinion as to what properly managed woods might yield.

367. Did you tell us in your statement what class of students attended your lectures?—No, I have not stated that. They are all men interested in the management of land in some form or other. As you know, there is a Chair of Agriculture, and a Degree in Agriculture may be taken at the University. For this certain other subjects are optional. The subject of forestry is one of the latter, and a certain proportion of the candidates for the degree of B.Sc. in agriculture select forestry as one of their subjects, and to enable them to get the degree they come and attend my classes. Those men, I suppose, are looking out chiefly for factorships. Sometimes they are going to farm, and occasionally they are men who are going to the colonies. They are men who are interested in land in some form or other. I have also had a certain number of men who are the sons of proprietors. Several of them have been the eldest sons of proprietors who ultimately were expecting to come into properties themselves, and they have attended my classes to learn something about the management of woods. I have had a few working foresters. Within the last three or four years a bursary was established by the owner of Raith, and it has provided every year a working forester as a member of the class.

368. I observe that during the year when there was no payment of fees in your class, there was a great extension of the number of your students?—Yes. I will tell you the history of that. It was the first year I came up to Edinburgh—the year 1891-2. The course ought to have begun in October, but there was no one to give the lectures, as Dr. Somerville had left about that time. I came up early in January. A short course was put on by the University authorities, and there was a discussion about the fees. I was very anxious to have a number of students attending the class, and I thought it would be very desirable to take no fees if possible. I therefore went to the University authorities and asked them whether, under the circumstances of the short course, they would agree to charge no fees. They hesitated very much to do this at first, because they said it established a bad precedent. But ultimately they agreed, and the result was that I had actually 40 students. The next year I suggested that as it had answered so well we might charge no fees again, but the University authorities did not see their way to that, and a fee of £3 3s. was charged, with the result that I only got a quarter of the number that I had before.

369. Do you anticipate any advantage from Mr. Carnegie's benefaction?—I hope so.

370. But the non-payment of fees had an important bearing on the number of students in your class?—It had.

371. Do you think it desirable to have safeguards against the probable dearth of the world's timber supplies?—I think so, certainly. I believe Dr. Schlich will make a very full statement on that point. I have made some mention of what my friend Mr. John Mitchell, the timber merchant, told me. He is very emphatic on this point, and I have had many conversations with him about it. He will tell you there is no question that the timber supply is falling off so far as quality goes, and that prices are rising. He is a man who knows his business very thoroughly, I think, and takes a great interest in it; he has told me of matters within his own recollection, and there is no doubt the imported timber is now of a comparatively inferior kind. You have only to go into his yard or any other of the yards I know about Edinburgh to see this for yourself. You will find an immense quantity of the timber is cut from small trees. Large quantities of it consist of trees cut in halves through the pith or thereabouts, and the slab just taken off the top. There you get a waney piece. But I have asked Mr. Mitchell whether that was the sort of stuff he used to get 30 or 40 years ago, and he said that it was not; that it was then not thought worth while to bring it over, but that now very little else is sent to this country. I mentioned also the case of the railway-borne or land-borne logs that he got over, of which Mr. Mitchell showed me some samples the other day. He said: "This is the first batch of logs we have had in our yard which have evidently been carried by rail, and it is a new thing."

372. While substitutes are no doubt frequently found for timber in regard to certain purposes, yet there is always some fresh demand arising for timber?—Yes, the use of timber in the world is greatly increasing

Colonel F. Bailey, R.E.

22 Apr. 1902.

I have no doubt. In connection with the supply from abroad, I may perhaps mention a visit that I paid three or four years ago to Canada, when I went across the continent from the Atlantic to the Pacific. It was a dismal sight when passing through that splendid country to see the destruction that had been wrought by burning. They have some kind of nominal organisation, but the practical result is that the timber is burnt off the face of the earth. You can go by train on the Canadian Pacific Railway, and day after day you will go through nothing but burnt poles. This was caused in the beginning by the contractors setting fire to the forest for the purpose of clearing a way for the railway, and by the settlers in the backwoods for the purpose of clearing their settlements. They had a tract of land given to them which was burdened or cumbered with fine timber. The timber was of no advantage to the settler, and he did not want it. What he desired was an open space in which to grow agricultural crops, potatoes, corn, and so forth, upon which to feed his family; but when he found the ground encumbered with great trees he had to clear them off, and the simplest way to do it was to put a match to it and fire them, which he promptly did. The fire spreads far and wide. As all the settlers were doing the same there was, of course, a great deal of burning. When they desired to put the fire out they found that they could not. When the ground has once been burnt over the health of the trees that may not have been actually killed is very much affected; they all become drier, and the next time a fire comes along it burns them clean off. I have been a little in the United States, but not enough to speak very fully about the state of things there, but I believe exactly the same thing is happening over a large proportion of the United States.

373. Do you think that in this country some further precautions ought to be taken against fires?—Most certainly I think they should. I am happy to see that they have invented a smoke box or some other apparatus for preventing fires caused by the sparks from engines. I am afraid there is a great deal of damage done in this country by fires which are avoidable. To begin with, proprietors ought not to plant young conifer woods right up to the edge of the railway. Why should not they put a strip of hard woods which are less inflammable along the edge of the railways for protection? It is only common-sense to take such precautions as that. We never think of taking any precautions at all, but plant inflammable trees up to the very fences of the railways, and then cry out when they are burnt. I think the same thing might be done with regard to the damage by wind. A great deal of damage has been done by wind, though a large part of it has been unavoidable. When you get such tremendous gales as occurred during the year of the Tay Bridge disaster—in 1893 and 1894—no doubt damage could not be entirely avoided, but at the same time my experience is that gales of that sort do not pass over the whole country, but run rather in narrow channels, doing damage in strips. If a certain strip of country must suffer there is no reason why the whole country should suffer from moderate gales as it now does simply because no precautions of any sort are taken. The kind of precaution I allude to is the growing of protection belts of well-rooted trees especially trained to withstand winds on the outsides of forests, and along roads and rides; also on other parts of large extents of land where you require to duplicate or triplicate the lines of defence. Again, in felling woods, where a part of the wood is taken, it is the practice to cut the outer trees along with the rest, and I think that is quite wrong. The outer trees should be either never cut at all or should be left until the whole of the other cutting is done. If those trees have stood during the years that it has taken them to grow to their present size, they will probably stand during the rest of the period in which the wood is being cut down. I should wish to have the outside trees of all woods on every side, unless such woods were particularly sheltered, maintained for the express purpose of protecting the trees that grow within, and I should not advocate felling them at all. Let the trees, when they become old and ragged, be replaced by others planted to fill up the gaps.

374. I have just one other question dealing with æsthetic considerations. Many people seemed alarmed at the prospect of the introduction of what is known as commercial forests into this country. Are not many of the French, German, or Hungarian forest along the Vosges, the Rhine, the Carpathians, or the Danube, as beautiful as the ordinary average British wood?—I suppose all matters of beauty are matter of taste. To my mind they are more beautiful, and that certainly was M. Boppe's idea. I have heard a good deal said about this subject, and I think a great deal of what one hears is said by people who have never seen well managed woods, and who picture to themselves something very unsightly. I do not see anything unsightly in them myself. If you had an area of 800 acres of Scots pine on a rotation of 80 years system, you would have plots of 10 acres or thereabouts, each plot differing in age one from another. Those plots would not be all arranged in a row, but would probably be situated in two or more different parts of the estate. There is by no means a complete sameness and monotony in such a crop as that. Some of the crops would be old and just coming to the axe, while some would be middle-aged, some young, and others just springing up. In fact, there would be all gradations. You would have beechwoods, ash woods, oak woods, and I think there would be a very great variety about them. It is quite an error to say that such woods are not beautiful.

375. (*Dr. Somerville.*) Following up the particular point you are on now, I suppose it is a fact, is it not, that the most popular health resorts on the continent are well supplied with forests in the neighbourhood?—As far as my knowledge goes they are.

376. Such resorts as Homburg, Wiesbaden, and others?—Yes.

377. The health resorts on the continent which are resorted to by English people and others evidently prove quite as attractive as our English forests?—I think they are very much more so.

378. They go there, in fact, in place of going, for example, to the New Forest, and apparently it is altogether a mistake, is it not, to imagine that enjoyment is not derived from a sojourn in the neighbourhood of such forests?—Absolutely so. I would go one step further and say that even supposing that a proprietor desired particularly that a part of his woods should remain in a particular condition, that does not oblige him to keep the whole of his woods in that state. For instance, if he wished to have a lengthy carriage drive leading up to his house kept in the wild condition in which he has seen it from his childhood upwards, there is no reason why he should not mark off a strip on either side of the road and do what would be much better from a commercial point of view inside that limit.

379. You mentioned that it is a common practice in Scotland, and I suppose also in England, to leave land unstocked for some years after the wood is felled. I suppose you do not find that prevails under a scientific system of sylviculture to the same extent on the continent?—It certainly should not. When I first went to Scotland I was a great deal puzzled by the practice of leaving the ground bare for four or five years. I looked at "Brown's Forestry" to find out whether he said anything about it, and I found he simply said it ought to be so left, but did not say why. I afterwards came to believe that it was on account of the attack of the weevil, which no doubt is a very serious drawback, and does a great deal of damage to young plantations. I have no doubt therefore that it is to let the weevil die out from the stocks of the trees that the ground is left blank. Whether that is the best way to deal with the difficulty is another matter; I am not by any means convinced that it is. I think it would be better indeed to face the weevil in some other way, and not to lose four or five years' growth on the ground. What I was alluding to when I said the ground was not planted up was rather that tracts of land are left longer than is necessary to destroy the weevil; tracts of land are sometimes left eight or ten years without anything growing upon them. There is a very great loss from this system, because not only is the land producing nothing all the time—and in any calculation of the annual produce that it yields in the future the lost time has to enter into the divisor—but also because the soil gets in the meantime covered over with an impenetrable jungle of bramble, broom, bracken, and things of that sort, which render the re-stocking of it by planting and sowing difficult and very costly on account of the number of death vacancies that have to be filled up. If the ground could be re-stocked immediately after the crop has been taken off, this would be far cheaper and far more profitable. There is another point which your question suggests to me, and that is with regard to the filling up of vacancies. It is a common practice in many parts of Scotland to plant a wood at so much an acre; it is probably planted by contract. That having been done it is left, under the idea that all that is necessary has been done to it, and that it may take care of itself; whereas it

possible. But I must say that the idea struck me when reading it that he may have been arranging for a 100,000 a year for some time, and it is possible that is what he meant, and that he could not secure a regular yearly supply. It might have been that. I was not quite sure myself when I read it.

399. Then you very kindly told us about the trees used for shelter. What, in your opinion, are the best trees that one could plant, the best conifers for the outside of a plantation to provide shelter?—Very much would depend upon the locality, but there are certain trees that are particularly good in high levels. I think the mountain pine is as good as any. The Austrian pine and the Corsican pine are also good trees. The silver fir is very strong rooted and able to stand against winds. It depends on what you are wanting the shelter against, whether it is against cold winds or strong winds.

400. And it also depends a great deal on the growth of the plant?—Yes.

401. For instance, if you put up a kind of Corsican pine at the same age as the Scotch fir to protect them, the Scotch fir would go ahead so much faster that the Corsican pine would not protect them at all?—Yes.

402. I have always heard that you cannot plant a better shelter tree than the Austrian pine; is that your experience?—I think it is a very good tree for the purpose.

403. In your long experience in Scotland, have you studied the subject of rates at all on woodlands?—I confess I have not.

404. And the question of labour also. In your experience is there an abundance of labour for all forestry operations there?—I do not think I have heard of any shortage. I have not heard of any difficulty in getting the amount of labour necessary.

405. Are not the wages paid rather higher than they are in England? Does not an ordinary man in the woods in Scotland make his 18s. or £1 a week as against the ordinary agricultural labourer in Essex or Suffolk who only gets 3s. to 12s. a week?—I think you are right in that.

406. You say you have not gone into the question of rates, but I have been led to believe by reading up the evidence that the rates on woodlands in Scotland are very light indeed compared with the rates on woodlands in England, and I was wondering whether we could do something to encourage the planting of woods in England if we could get relieved of thes rates altogether or get some reductions, and also by a reduction of the death duties. Have you considered anything about death duties at all?—I know they are a great difficulty in the way of planting.

407. Have you had experience of that?—Certainly, I have heard it said.

408. (*Sir John Rolleston.*) You said there were indications that the forests of the world are being depleted?—I think so.

409. And an inferior timber is coming into this country now?—That is what I believe.

410. I suppose we can only look to certain parts of the world, not the whole world, for the timber supply, the temperate zone only?—Yes. We have not yet attempted to bring wood from the tropics. Of course we do bring some woods, such as mahoganies and special woods of that kind from tropical countries, but as a rule the conifers come from the temperate regions I think Dr. Schlich has stated that we get 87 per cent. of conifers from the temperate regions.

411. The forests of India, with which you are acquainted, are of no use for the supply of timber to this country, are they?—No, except for special kinds, such as furniture timbers and teak.

412. Nor would the large central forests of Africa be available?—I do not think so for our purposes.

413. Therefore it is only the woods of the temperate zone that we have to look to?—I think so.

414. That seems to illustrate your argument that timber planting in this country would be profitable?—Yes

415. Is there any way of making trustees realise that? So much of the land in this country is in the hands of trustees, and nothing will persuade a trustee to plant trees?—That is my experience, too.

416. Is there any way in which we can make the planting of trees attractive to trustees?—I should say that if you began by having a model forest, which would show the profits derivable from a properly constituted wood, you might induce them to look at it. So long as the popular opinion is what it is I do not think trustees can be expected to go in for sylviculture.

417. The way to excite interest in it is to establish model forests in your opinion?—I do not see any other way. I want to show the people what can be done. What I would like would be to induce as many large proprietors as possible to go abroad and see what is done in Germany, France, and other countries. You cannot take the ordinary forester there so easily, but the proprietors themselves, who probably travel a good deal, might easily—or some of them at least—go in a properly organised expedition of discovery and see what is to be seen. I think if they did that it would go a long way to induce them to take the matter up, but there will always remain doubt in their minds that what they saw done there could not be done here, and I wish to have that demonstrated. I do not see how you can expect any private proprietor to undertake what we require. I am sure no proprietor will, and we shall have to rely upon the State to give the lead. Again, it must be said that it takes a great many years to show the results of the proper working of a forest, and owing to changes of ownership from death or sale and changes of management, and seeing that the proprietor up to the present time has complete power over his estate, there is no certainty that the woods on it will be managed for the necessary length of time on a regular system. It is on a State area only that a model forest can be established.

418. (*Professor Schlich.*) I should like to ask a question or two with regard to the arrangements for education, more particularly with reference to Scotland, in which you are specially interested. We have heard something about a forest garden and a model forest, and I should like to know whether you agree with me that the forest garden, unless it is of enormous size, can be used chiefly only for two things: first to show how to grow plants as a sort of school nursery, to show how they are transplanted and treated when they are quite young; and, secondly, for the study of forest botany in the arboretum. Do you think that a forest garden, unless of enormous size, could be useful for any other purpose?—For no other purposes than those. It is very important, speaking for Edinburgh, that we should have there a place of that sort. We have no place where you can go and get plants and show the students how to put them in, or the kinds of plants produced in this way or in that way.

419. I start from that. I start with the assumption that we have a forest garden, and what you call a model forest. I may just as well say that I think a model forest is a rather unfortunate term. I should call it a school forest?—Yes; it may be better to call it a school forest.

420. I will use the word school forest, as it suits my ideas a little better. In the case of a school forest, would you prefer a blank area to start with, or a place more or less already under wood?—The latter, under wood.

421. I quite agree with you in that. In this school forest we could teach a certain number of systems or methods of treatment, as Dr. Somerville has already mentioned, but of course there are limits to that. You may have an area for a school forest in one place which might not be suitable for all the different methods of treatment which it is important to teach. Under these circumstances ought we to stop simply at one school forest? We could not very well have two, three, or four school forests, because it would not be financially possible; but do you not think we ought to interest landed proprietors a little more so that they would lend their forests to be used for the instruction of the students in addition to a school forest; would not that be an important thing? We have an excellent example of that in our worthy Chairman, but I should like to see not only one but a dozen or two dozen landed proprietors in Scotland put their shoulders to the wheel, and offer assistance?—What do you mean exactly by "lending?"

422. Allowing the use of the forests for instruction? —Who would manage them?

423. I will go a little further. I know an instance in the Austrian Empire, in Bohemia, and Moravia. There the landed proprietors met together and established a forest school of their own

Colonel F. Bailey, R.E.

22 Apr. 1902.

their own expense, each contributing so much. They thus established a forest school to train the forest officers for their estates, and all the estates were available for the instruction of students under the guidance of the professor of the forest school. Would it not be possible to start something of that sort in Scotland?—I think it would be most desirable if it could be done, but the great obstacle to starting it is that the proprietors in Scotland have not the same advantage that those proprietors have whom you speak of. They have State forests, which they have all seen and know about, and the consequence is that they are fully impressed at the commencement with the capability of their ground for growing woods, and with the desirability of imparting instruction to their subordinates who manage them. Our proprietors, speaking of them as a body, are not convinced of that yet, and therefore I do not think they would be likely to come forward in the same way that the Austrian proprietors did.

424. We have convinced our worthy Chairman; why should not we convince a great many others?—It would be an excellent thing to do so.

425. I will leave that for the present, and come to another point. In this school forest of course all the forestry operations as far as the locality permits will be shown?—Yes.

426. You have told us that students who attended your lectures consisted partly of the sons of proprietors, men who were preparing to become factors or agents, managers or farmers, and also a few foresters—do not you think it was a mixed crew?—Very.

427. Do not you think we ought to make a little division there?—That I have proposed already to do, because I said I should teach the working foresters in the forest, that they should be taken on as apprentices, and employed actually working with their hands in planting, and in other forest operations, and then at certain times of the year, or certain days of the week, however it might be arranged, they should have lectures given them in the theory of the business. Of course at the present time we have no such place, and if we do get hold of a working forester we are obliged to teach him in the only place there is for him to go to.

428. What I am driving at is this, and I see you agree with me—to arrange a course of instruction at Edinburgh University for rather a higher class?—Certainly.

429. And have in your school forests an absolutely competent manager?—Certainly.

430. To whom your apprentices would go and with whom they would work?—Yes.

431. You must have a man who can give the ordinary current instruction in the forests to be controlled by the principal professor who conducts the instruction at the University?—Yes.

432. As you agree with me so far I will now come to the next point?—I am quite in agreement with you so far.

433. Do you not think we ought to go in for the establishment of a Faculty of Rural Economy at the University of Edinburgh, say for agriculture and forestry combined, not to have forestry as an appendix to agriculture, but to let them stand alongside of each other. Let one man who wishes principally to devote himself to agriculture take forestry as his second subject, and let another man who wishes to become principally a forester take forestry as his principal subject and agriculture as a second subject, so that you would provide a number of competent managers for agricultural estates and also managers for forest estates. If such a thing was done, we should probably be able to supply our clients with forest experts, and I want your ideas on that point. I want really to know whether you would support such a scheme as that?—Yes, I think I would. It is a new idea to me, but I think probably it would be a very good thing. There are extramural arrangements of that kind in Edinburgh. There was an institution they called the School of Rural Economy, at which forestry and agriculture, and many other things, including dairy work, such as cheesemaking, and so on, were taught. That School of Rural Economy has ceased to exist now under that name, and its place is taken by the Edinburgh and East of Scotland Agricultural College which is working on these lines. They have only recently started, and they have not yet developed anything in the line of forestry, although I believe they contemplate doing so. I may say that when the School of Rural Economy was in existence under that name they had a certain number of lectures given at the Heriot-Watt College in the evenings by myself to a class which numbered in the first year about 30. It then fell off, because I think the chief part of the students who came were men working in lawyers' offices, who wanted to get acquainted to some extent with this business, and having taught the apprentices of the day we must, of course, wait three or four years before we get a new lot.

434. That is not exactly on the line on which I am travelling?—I appreciate that, and I merely mention it to show that agriculture and forestry have been taught together in one establishment before.

435. I am told that there is an agricultural college at Cirencester where there is a course of forestry which consists of six lectures in the year. I do not think that is much. I was thinking of an establishment where we could educate all the men, not only for this country, but for the colonies, and I want to know whether it is worth while spending money upon it?—Yes, I think it would be an excellent scheme.

436. You would approve of that scheme?—I would.

437. You spoke of inferior timber. Do you mean by that timber of small dimensions?—That is what Mr. Mitchell told me.

438. Do you happen to know where that timber came from?—Yes.

439. Was it Baltic timber?—It is imported timber. He gets it from the Baltic and from Finland, and all about there, Norway, Sweden, and all the North of Europe. He also gets a considerable amount from Canada, pitch pine, yellow pine, butter-nut, and other sorts of wood.

440. You do not know exactly where it came from?—No, but I could easily tell you that later on. I cannot remember where the timber was obtained, but I think I am safe in saying that the timber I have seen there of small dimensions came from all these places I have mentioned, some from each.

441. (*Mr. J. H. Lewis.*) A change in the quality of timber indicated that the supply was diminishing at its sources?—Yes; what usually happens is this: When exploiters, traders, go to a place, they take the finest trees at first, and then they go further and further, taking always the largest trees. After they have got a certain distance it becomes difficult to transport the trees over such distances, and then they go back and start again, and take a second quality, and then a third quality, and so on until they have cleared the whole crop out.

442. The deterioration in the quality shows that the timber supplies are giving way, you think?—Yes; at any rate, those which are accessible. There may be supplies further inland. But I have read pretty steadily some of the timber journals in regard to this matter, and I have been very much struck with this fact in regard to news from the Baltic and Finland, that when you read of a great development of the trade you never see a single word about the condition of the forests in which they are getting the timber. But you hear that a new railway line has been made from such a point to such a point, opening up the mountains, and that 10.000 or 10,000.000 logs are expected. That only shows that they are going further in the process of denudation.

443. I presume that the manufacture of paper from wood pulp is operating to diminish the stocks of timber very rapidly?—Yes, especially as they require young wood for that.

444. That is really an appreciable factor?—It is a most important factor, I think. If they would limit themselves to cutting nothing but large trees, and would leave plenty of small ones, there would be very little harm done; the old ones would be replaced quickly by those of the class next below them in size.

445. You told the Committee your experience in crossing from ocean to ocean in Canada, and mentioned the hundreds of miles of blackened tree stumps caused by forest fires; can you give the Committee any information with regard to the clearances on the banks of the rivers?—No; I am afraid I cannot do that. I only made a hasty visit, and I went across by the Canadian Pacific Railway, and did not go about the country much. I

went to a place called the Algonquin Park to the west of Ottawa, where they have a million acres, which has been taken up and reserved by the Government, partly as a reserve for timber and partly as a sanctuary for wild animals.

446. Do you know to what extent planting is going on in Canada?—I cannot say. I could not give any figures. I do not think they are doing much.

447. You are, no doubt, aware of the movement in the United States for replanting?—Yes.

448. Do you think that that would to any extent affect the timber supplies as far as we are concerned?—I really could hardly answer that question. It must take a great many years at any rate before the timber which is now being planted can become available for our market. There is no question about it, I think, that in Canada they have not replanted anything approaching the quantity of ground they have denuded. I daresay Dr. Schlich, who has gone more into this question than I have, will be able to quote to us some words that have gone from my mind just now in regard to a statement made by an American statesman on this matter. He gave some figures which tended to show that they were destroying their woods hand over hand, and doing nothing to restore them. I do not, however, remember the words just now.

449. In that case, if the world's timber supply is diminishing so rapidly, it becomes for this country, which needs such a large supply of timber, a national question?—It is evidently so.

450. You have suggested, chiefly for the purpose of instruction, the acquisition of a State forest. What area would you suggest for that purpose?—You mean what minimum area do I think is of any use?

451. Yes?—That is a very difficult question. I might prefer, for instance, to have two small areas, or relatively small areas, one in the hills and the other on the low ground, to having one very considerable area in one place. It is a great advantage to have a good big area, but, on the other hand, it is also a very great advantage to have a variety of soil and situation, and I think I would have to be satisfied with the biggest thing I can get. I do not think it would be much use having a tract of less than, say, 1,000 acres, or something of that kind.

452. It would, I presume, take a very long time indeed to effect any great change as regards the amount of timber grown in this country merely by having better education in afforestation?—Evidently that is so, but we must make a beginning at some time.

453. Or by having a State forest of a thousand acres. We have heard that the difficulties of landowners have to be overcome, that trustees are unwilling to plant, that a number of landowners have not the means to plant, and that a number of landowners in any case, even if they had State loans, would probably object to burdening themselves and their land. Under circumstances of that kind, having regard to the diminution of the world's timber supply and the necessity of increasing our own resources in the future, would not you be disposed to go a little further and to suggest that the State itself should acquire waste land which could be used profitably for the purpose of producing timber?—I think it would be a most excellent thing if the State could be persuaded to do it.

454. Do you know what revenue the State derives from its forests in Hungary; you have visited Hungary, have not you?—Yes, I have; and I have a little pamphlet which gives the information you require, but I cannot give it without reference.

455. They have a very large number?—Yes.

456. They do much for education?—They have a splendid school at Selmetz Banya.

457. I will not trouble you about that?—They have a very fine forest school at Selmetz Banya, with magnificent museums and a full equipment of professors. I have visited it.

458. You mentioned that a Scottish County Council was doing some work on its own account, I think. Do you know anything about what the County Council of Northumberland has done recently?—I do not; I have not heard of their operations.

459. You have had also considerable experience in India?—Yes.

Colonel F. Bailey, R.E.

22 Apr. 1902.

460. The Secretary of State for India a few weeks ago gave me some information as to the increase of revenue from the Indian forests. Do you happen to know whether this is on account of their cutting down the Indian forests, or better management, or what is the cause of it?—It is from the better working of the forests. It is certainly not from overcutting or diminishing capital stock. I have not the slightest doubt that the capital stock has largely increased, while at the same time the output is also increased.

461. (*Professor Campbell.*) You have told us that the timber supply of the world is rapidly diminishing, and that we ought to plant more in Great Britain; that the system which should be adopted is the continental system; that a great deal has been done, hitherto, to educate foresters and landowners in that system, and now we are in the position that we want to educate still further. All that is exceedingly interesting, and I quite agree with you; but I want to ask one or two more questions as to the method of imparting this instruction. At the Edinburgh University, of the number of students attending your classes a large proportion would be young men going back to farming, I think you said?—Yes, farming and estate management.

462. How many foresters do you think will have been turned out of that class since it started?—Purely and simply foresters—very few.

463. Do you believe that is largely due to the fact that they are not sufficiently remunerated?—Yes. I think it is wholly due to that fact.

464. I do not know whether it is a fair question to ask you, but I should like to have some idea of the remuneration given to a head forester?—You can get that information from others better than from myself.

465. I suppose a head forester would perhaps get £100 a year and a house?—Yes; it varies very much. It depends upon the size of the estate.

466. But £100 is not sufficient to induce men to go up to University classes?—Such a man cannot do it. That class of man cannot afford to refrain from earning his bread during the time he is studying.

467. Your proposal would be to reserve the University for the education of landowners and their agents, and to teach the practical forester in a forest school?—Yes, in the beginning. But I have a firm belief that after a time, when proprietors begin to realise the value of their forests, and the necessity of having them managed by skilful and highly-trained people, the salaries of wood managers and head foresters will increase to such an extent that that class of man can be trained in the University.

468. But you think a good deal could be done by teaching practical foresters in a forest school?—That is the proper way to begin, I think.

469. In addition to a forest you would have classrooms in which you would give these men lectures and instruction, and not bring them to Edinburgh at all?—Yes.

470. So that the forest school would be of more advantage to the forester than to the University student?—Yes, except that it is impossible to teach the University student now without having some place in which to give him practical instruction.

471. The model forest would act as a school to the young forester, besides giving a demonstration to the University man?—That is so.

472. Supposing you had a number of good foresters, trained men, do not you think a good deal could be done if these men were made inspectors of forests? We have in Ireland itinerant instructors in agriculture, men who go round and visit the farmer, spending a day or more with him, and going into all the business of his farm. Would not the same thing apply to foresters, a really good forester going to visit a landowner, or agent, or whoever might be in charge of the forest, small or large?—I think something might be done by having professional advice, periodically given.

473. Would it be possible, do you think, to take a forest as managed now on the English system, and, by sending periodically a skilled man, to carry on that forest on the new system? Would, say, ten or twelve or

Colonel F. Bailey, R.E.

22 Apr. 1902.

twenty visits per annum be sufficient ?—I do not think so. It might be very useful in controlling the work of a man who has had the education necessary for a working forester in the beginning, but if that man has never seen the various operations properly carried on, I do not think any amount of casual visits by an expert to tell him to do this thing or that thing, would lead him to understand what he was told, or to do it properly.

474. That would be impracticable, you think. But suppose you had a sympathetic forester and a sympathetic agent or landowner ?—It would do some good, no doubt ; but it would not meet the case.

475. You would not recommend me to advise an Irish landlord to adopt that plan ? Would it be injudicious ?—If he could not get anything better, then he had better do that ; but it would not effectively meet the difficulty.

476. You do not think it is a satisfactory method ?—Not at all.

477. You think that nothing short of a complete course of technical and practical forestry would suit for a head forester ?—At this point I should like to remark on the very great value of the woods on a large estate. If you were to take the woods on a large estate, such, for instance, as the Beaufort Estate, in Inverness-shire, the capital value of those woods must be something enormous and the possibilities of revenue, assuming that the area or a considerable portion of the area were managed on proper lines, would be very large and important. To have them correctly managed you evidently require a man who has been highly trained ; a few visits now and then by someone to tell him what to do would not be considered enough in any other business. I think forestry requires more special teaching than anything else. It is certainly a subject on which there is no general knowledge, and, as I have often said, it requires more practical illustration than anything else that I know about.

478. But supposing the sympathetic landlord who is managing his own estate were in a position that he could call on an expert at any moment by paying a certain sum, do not you think that is sufficient ?—When the expert came he would say, "This thing is not properly done, and you must do it in such and such a way" ; and when he came back six months later he would find it again not properly done, and he would have to give further instructions, which might or might not be followed, and in the meantime the management would be defective.

479. I was referring more to the planting ?—Of course, planting is more mechanical, and no doubt something could be done as regards that.

480. Even assuming we get a forestry school, if we have to wait until we get our trained men I am afraid it would be a long time ?—Some time, no doubt.

481. Planting should be done before that, I think ?—There must be a gradual progress, no doubt. You must do the best you can until you get a full-going machine.

482. The system that Dr. Schlich has referred to, whereby you would have at the Edinburgh University, not an agricultural faculty with forestry added, but forestry on an equal footing with agriculture, would, I presume, not be permitted by the regulations of the University ?—I am not aware of that. I cannot answer for the University. It does not strike me that there is anything impossible in it, but I do not know.

482*. (*Mr. Stafford Howard.*) You have a wide experience of estates in Scotland, on which there is a good deal of woodlands ?—I have seen a great many.

483. In referring to the Raith Woods you said there were a certain number of old woods which were carrying only half a crop on them. Should you say that is true generally of most of the estates now ?—Yes, I think it is true of most of the estates I have seen.

484. You are strongly of opinion that there is great room for improvement ?—I am of opinion that there is great room for improvement, and that the present older woods are greatly understocked.

485. That is [illegible] generally ?—Speaking generally, only a very light crop of trees, far inferior to those which might have been produced had the sylvicultural system been better.

486. You lay very great stress on the necessity for practical education in the forest as well as in the lecture-room ?—I cannot insist too strongly on that.

487. What proportion of time ought a student to devote out of doors in the forest as compared with that which he spends indoors in the lecture-room ?—I think that is a rather difficult question to answer. I would rather prefer to give you the actual figures of what is done in some places.

488. They are, perhaps, limited by what they can do, but my idea was what they ought to do. What do they do in India ?—In India we had lectures in the lecture-room for about three months, and then there was about a month's holiday, which left about eight months for outside work. But the lectures and the outside work were concurrently carried on.

489. Carried on in the forest ?—Yes.

490. That is undoubtedly the best place, to have a forest at hand if you can ?—Certainly you want to have a school forest as near your door as you can get it.

491. The other question I wished to ask you was this. You said that vast areas of waste lands could be planted with great advantage to the country generally. What do you mean exactly by waste land ?—I mean land now under heather or rock, and with no crop growing upon it. No doubt there are grazing lands and shooting lands which could be utilised.

492. You include grouse moors, deer forests, and grazing lands, do you ?—Yes, I include all those.

493. Do you think that if they were planted they would produce more income than they produce now—do you hold out that temptation to landowners ?—I certainly think in a great many cases they would give more than the average returns from grazing and shooting. I would rather put it this way. The amounts obtained from grazing and shooting are, I believe, very variable ; they depend on the situation of the estate, and also on other considerations ; but I am quite sure that there is a great deal of land now used either for rough grazing or for sporting purposes which under forests would yield a much better income to the proprietor. I may perhaps refer for one moment to what I said on that subject in the Raith working plan. I said "Of the 808½ acres composing the working circle, 137 acres have been under cultivation, and thus employed are capable of yielding a net annual rental of 9s. per acre." These figures were not worked out by myself, but were given to me by the factor. Or rather he and I went together over them, but he is more responsible for the figures than I am. I go on to say, "479½ acres are suitable for rough grazing, yielding a net annual revenue of 4s. per acre, while the remaining 192 acres are waste, yielding nothing if not stocked with trees. The annual average cash surplus derivable from the whole of this land, if not afforested, is slightly under 4s. per acre, which is a maximum figure." That is a case in point. I also make a similar statement in regard to the Novar woodland. I am not certain that I can easily put my hand upon it, but I think it is very much to the same effect.

494. You say that probably on every estate on which there is a large amount of this waste land, certain proportions at all events would be better planted than what they are now ?—Yes. You asked me about the time spent in practical work. Reading from my report on the French forests : "Each year of study at the school, 2½ months of practical instruction, one month occupied by examinations ; and there are two months of vacation." Then I go on to explain in general terms how the courses are arranged. They get 2½ months there of practical work each year. Dr. Schlich will tell you how he arranges the courses at Cooper's Hill in that connection.

495. (*Sir John Rolleston.*) Arising out of a question asked by Mr. Stafford Howard I should like to ask you whether there is any altitude above which planting is unprofitable—any contour line ?—No doubt there is for each species, but it is not altogether the altitude that would determine the profitability. The desirability of planting with the view to profit at any altitude

Colonel F. Bailey, R.E.

22 Apr. 1902.

would depend upon other circumstances; for instance the aspect, the extent to which the place was subject to cold winds, and so on.

496. But is there any part of the United Kingdom which could not be planted with some species of trees?—Certainly.

497. The top of Ben Nevis could not be planted?—No.

498. (*Chairman.*) I suppose it would be a safe thing to say that the existing area under timber in this country might be easily doubled or trebled?—Yes, much more than that.

499. You think much more than that?—Yes.

500. (*Professor Campbell.*) In connection with planting, you mentioned some land on which heather was growing; was that peat or bog land? Is peat land suitable?—Yes, peat land can grow pretty good trees of a certain kind. Of course it depends altogether on the depth of the peat, the drainage, and so on.

501. You do not know the bogs of Ireland, do you?—I have not been there yet. Dr. Schlich will tell you all about that.

502. (*Chairman.*) There is one little matter which I should like to clear up in my own mind. What is the difference between a model forest and a State forest?—A State forest is a forest owned by the State, whether for a school, model, or other purpose.

503. What do you consider your scheme to be?—I have called it a model forest, and Dr. Schlich has called it a school forest. It altogether depends on the object you have mainly in your mind. I have stated somewhere the objects for which State forests are wanted. The first one that came into my mind was the practical teaching of my own students. For that purpose it is evidently a school forest: but I wanted the State forest for another purpose, as an object lesson to proprietors, that they might be induced, by seeing what could be done, to try on their own estates something of the same sort; that is a model forest; if you like. So that really its name depends on the particular object you have in your mind at the moment. I have no doubt the more correct title is school forest, and I shall be very happy to call it so in future.

504. You do not think that private enterprise will very rapidly cover all the waste lands that are available for timber culture in this country?—I do not.

505. And you would look in part, no doubt, to the result of the establishment of a school forest, or model forest, for the training of the foresters, as one of the means by which ultimately the operations of the State might be facilitated in undertaking work of that kind?—That would be so. What I feel is that few people have done anything at all towards developing this industry I feel that nothing will be done until the State makes a start. My own fixed belief is that if the State did make a start others would soon follow its example.

506. It would be important, would it not, to choose a site where you could have the greatest possible number of demonstrations, whether in growing timber, transport of timber, or utilisation of timber?—Yes, every branch of forestry must be carried on in the best possible way there, and under the most varied circumstances; that is what you want. So that everybody who came could find out something which would fit his own estate.

507. As to the forest garden, would you have a forest garden of 150 acres, showing, it might be, two or three acre plots?—I should not call that a forest garden at all. I think what you want is a comparatively small place near to your lecture-room, in which you can do exactly what Dr. Schlich indicated, namely, get specimens of young plants, teach sowing and planting, and illustrate many lectures by being able to walk into the garden and bring in things from it. That is what you want. When it comes to anything like sylviculture, that had better be dealt with in the forests. I see, on referring to my working plan of Novar, that in regard to the 4,000 acres there, with which the working plan dealt, it is said that if those 4,000 acres of land were not occupied by woods they could not be expected to yield on an average more than 3s. 6d. per acre from grazing and shooting. That is Mr. Meiklejohn's statement.

SECOND DAY.

Wednesday, 23rd April, 1902.

PRESENT:

Mr. MUNRO-FERGUSON, M.P. (*Chairman*).

Sir JOHN F. L. ROLLESTON, M.P.
Mr EDWARD STAFFORD HOWARD, C.B.
Professor W. SCHLICH, C.I.E., F.R.S.
Colonel FREDERICK BAILEY, R.E.

Professor JOHN R. CAMPBELL, B.SC.
Mr. JOHN HERBERT LEWIS, M.P.
Mr. GEORGE MARSHALL.
Dr. WILLIAM SOMERVILLE.

Mr. REGINALD H. HOOKER, *Secretary*.

The Earl of SELBORNE, called; and Examined.

Earl of Selborne.

23 Apr. 1902.

508. (*Chairman.*) You put your woods under a forest plan drafted by Mr. Nisbet: I think it would be a matter of great interest to the Committee if you would kindly tell us the reasons that led you to adopt that course?—I only took to forestry about ten years ago, and I became very keen on it. I very soon became convinced that nobody in my neighbourhood or on the estate knew anything whatever about it, and it gradually dawned upon me that that applied not only to my father's property, but all the surrounding properties. Then I turned to the best hand books I could find, and read a great number of them, and I eventually read descriptions of the German system, and then I passed on to read Mr. Nisbet's book. I got into communication with Mr. Nisbet through his publisher, and discussed with him whether it would be possible, *mutatis mutandis*, to apply the principles of Continental and Indian Forestry to a small English estate, and we agreed that it could be done. That is the history of the Working Plan, but of course the Committee must understand that my estate is a very small one, although in that sense it is typical of a great many English estates. I think that the problem presents rather different aspects in England from what it does in India, or on the Continent, or even in Scotland, but the general principles can be applied.

509. Have you found the control of the woods and their management easier, and the returns better?—Of course it is really too soon to say. You must understand that there was no system of any kind in existence; there was no forestry department of any sort or kind on the estate. I have had to form everything from the beginning. I commenced with chaos, and therefore I am not able to state what the results are.

510. You probably find that it saves a great deal of trouble in making fresh arrangements for one's woods, having everything laid down?—There were no arrange-

Earl of Selborne.

23 Apr. 1902.

ments made at all. Everything was absolutely haphazard. The thing is now systematised, and runs perfectly smoothly. I know what it will cost me every year. I can make exact estimates of expenditure, and I am even now able, from the natural capabilities of the place, to practically make the returns balance the expenditure, but of course what I am really trying to do is to build up a property which will be valuable to my son and my grandson.

510*. You believe that the question of forestry is one of considerable importance to landowners?—I think it is of immense importance. I do not think English landowners have the slightest conception of the money they are throwing away, or that this country realises the amount of undeveloped property there is in forestry in this country. I may be entirely wrong, but my belief is that in years to come timber is going to be more and more a valuable property in this country, and that there is a very large amount of timber which is required in this country for building and for other purposes which foreigners supply us with, and which, to a large extent, certainly not entirely, we might supply ourselves with.

511. Do you think besides improving the existing woods there might be a considerable extension of the forest area?—I think a very large extension, because under the system of free trade, which has come to stay in this country, a great deal of agricultural land in the South of England is absolutely non-productive, and with an initial capital expenditure in afforestation it will become, I believe, very productive.

512. You find perhaps that the rent of land will hardly pay the fixtures?—No; it does not exist in my part of the country.

513. It has practically disappeared from the great part of the arable land of the country?—Yes.

514. In order to render the woods more productive you think it is desirable that there should be more knowledge of the subject of afforestation amongst owners and agents and foresters?—I do not think there is any knowledge of the subject at all. I think that landowners, the agents, bailiffs, surveyors, and the whole hierarchy of people in England who have to do with land, are absolutely ignorant of the very elementary principles of forestry. They know how to grow a good tree for ornamental purposes, but of what forestry means as a commercial pursuit they have not the slightest idea.

515. I suppose it might be taken that while our ornamental woodlands are the finest in the world our commercial woods are the worst in Europe?—I say most unquestionably the very worst.

516. Would you put in the forefront for consideration the forestry instruction of owners and agents, or of the head foresters and their men?—I think you must get at the owners first. You must make them realise that it is possible for them to very largely add to the value of their properties, that if they do not get any immediate benefit from it their young men will get some benefit later on, and that they are really laying up property of real value for their descendants. If you once get that into their heads then I think it will be useful to educate the foresters, but at the present moment I think a good forester is thrown away on most English landowners, because they do not understand what he is talking about. They think it is a hobby, and they prefer to have rabbits, which is, of course, fatal to forestry.

517. Do you hold any views about rabbits?—Rabbits and forestry are perfectly incompatible, and the English landowner, who is usually comparatively a poor man, has not the slightest conception of what his rabbits are costing him, or what his game preserve is costing him. According to my experience, it is not only rabbits, but it is mice too. The rabbits, of course, destroy anything that comes above ground, but the mice that swarm owing to the destruction of hawks, weasels, and stoats, absolutely prevent the natural processes of nature in afforestation. Millions of bushels of acorns that fall are eaten up by the mice.

518. It always seems rather hard luck that the man who does not keep ground game is the man who has to protect his estates against those who do?—Exactly.

519. Have any of your friends or neighbours shown any disposition to follow your example?—No.

520. (*Dr. Somerville.*) I am very much interested in the question of forest education. I have given lectures at Cambridge, and have consequently come into contact with land agents and owners to some extent. Do you think that it would be a good thing if systematic instruction in forestry could form part of, let us say, the course for an ordinary degree at our English universities?—Anything that you can really do to bring the subject before this country would be valuable, and that would be one very good way of doing it. If you do not begin you will not make any impression anywhere. You have to educate the land-owning class as well as the servants who work for them afterwards.

521. I suppose you would consider it easier to get at the land-owning class through the universities than perhaps through the agency of a fully-equipped forestry school such as we have at Coopers Hill?—I think you want them both.

522. (*Professor Schlich.*) Unless a landowner were a great enthusiast with regard to forestry he would be hardly likely ever to abandon his university course in preference for a technical training in forestry, or to supplement his university course with two years, let us say, at Coopers Hill?—No.

523. (*Dr. Somerville.*) The universities, I suppose, would touch a large number of men, although perhaps it would not affect them so thoroughly?—Yes. I do not think you would get any landowners at present to go through that kind of course at the university, but you might the kind of men who are going to be agents. Agents, of course, have very great influence over landowners.

524. But still the great majority of the young landowners that go up to the universities intend to take a degree, and in many cases they take a degree in law. Do you not think that a certain amount of instruction in forestry might very well form a part of the course, either for a degree in law or for a degree in economics?—I should strongly advise trying it.

525. Your woods, as I understand, are now under a definite course of management in accordance with the working plan that was prepared for them?—Yes.

526. Does the gentleman who prepared the Working Plan visit the woods periodically in order to see that his plan is being carried out?—Yes, he comes down every year.

527. I suppose that the details are carried through by your resident agent or bailiff?—Yes.

528. I presume that your bailiff had no particular acquaintance with forestry before he came to you?—He had a little. His mind had been turned that way, as he had been bailiff on the Northumberland experimental farm where you yourself were.

529. I was only going to lead up to this, that if you got that Working Plan prepared by an expert the man who sees it carried through need not himself have a very extensive knowledge of forestry?—No.

530. In your particular case I suppose you find that Mr. Nisbet's plan is efficiently carried out by a man who has not himself had a great deal of forestry education?—That is so.

531. The Chairman has indicated that a landowner might be greatly hampered in his operations of keeping down rabbits by the invasion of the rabbits from adjoining estates. In the case of domestic animals it is the duty of a landowner to so fence his land that he prevents the animals from getting on to the land of his neighbour and doing damage. Would you consider it reasonable that a game preserver, whose estate was overrun with rabbits, should similarly fence in his rabbits and prevent them encroaching on the land and doing damage to the property of his neighbour?—I have always thought it would be a perfectly reasonable thing to entitle one to claim the fencing off of rabbits.

532. But as the law at present stands you have no power in that way?—You cannot claim it.

533. (*Mr. Marshall.*) You were saying that you find the people who work in the woods know very little about forestry. Does that apply to the ordinary workman? Have you not a class of men in your neighbourhood who understand the going into woods and cutting the underwood, and that sort of thing, and making it up for the market?—Yes, they do that.

534. As far as doing what ought to be done in the woods by way of aiding the tree in its growth, or anything of that sort, they are absolutely ignorant?—They are absolutely ignorant. They are really very good woodmen in that sense; they can fell a tree very well

and are very good copse-cutters and hurdle-makers, but until I taught them—myself having been taught by someone else—they had not the slightest idea of how to cut a branch off a tree.

535. If forestry goes ahead, and people take it up, there will be a great deal of work for men in the woods; would your neighbourhood be capable of supplying as much labour as was required, or do you think there is a shortage of the ordinary sort of working woodmen in your part of the country?—I think there is a tendency to be a shortage undoubtedly now.

536. If the labour was put on a better footing altogether, and people really took up the question of forestry, I suppose the landowner would be prepared to pay good men a little higher wages than the ordinary agricultural labourer gets at the present time?—I think so, certainly.

537. It would be worth it, would it not?—Yes.

538. You told us about the working plan you have adopted. Have you done any planting at all?—Yes.

539. Have you planted mixed woods, firs and larch?—Mainly conifers.

540. Have you larch and Scotch firs planted together, or have you only planted conifers from an ornamental point of view?—No. I have planted plantations; the larch, Corsicans, and Douglas are the three I have gone in for strongest.

541. Have you put them in by themselves or mixed them together?—I started with pure larch plantations, but I had to abandon that because larch disease worked such dreadful havoc with the trees.

542. Have you had larch disease badly?—It was perfectly frightful. It was introduced into my plantation entirely through the ignorance of my people. Of course, I cannot say it might not have come otherwise. But about twelve or fifteen years ago it suddenly occurred to the then bailiff that the young larch plantations were thriving very well, and that he might get an important quantity of faggots off the lower branches, and therefore he cut all the lower branches off. They were tremendously thick, and we could not get through to beat. I cannot say whether larch disease would not have come in otherwise, but when he cut them off that was just the opportunity larch disease wanted, and it came in. In two years there was not an undiseased tree in the whole plantation.

543. I have seen several instances in that part of the country of the same thing, and I think the fault is that the workman, instead of using the blunt side of his hand-bill and knocking the branches off, wields the sharp side, and occasionally breaks the bark. Therefore the tree begins to bleed, and becomes susceptible to the disease?—These were all living branches; there were no dead branches.

544. But I think you will find that when it is very dense like that the lower branches have a tendency to come off without much difficulty?—I do not say they were all dead. They took off thousands and thousands of branches for faggots every year.

545. Were the plantations planted close together?—Not so close as I should put them. They were about 3 feet 6 inches to 4 feet apart.

546. My experience is that if you plant larch 3 feet apart, after five or six years they do very well, and nearly the whole of the young branches are then dead, and you simply send your man in, who goes along and with the back part of the hand-bill, instead of the front part, knocks off the branches, instead of cutting them, and in that way does not do any damage to the tree at all. I quite agree with you that damaging the bark is very apt to make trees susceptible to the disease. What do you think about the rates on woodland; do not you think it would be a great relief to people who want to do something in forestry to be relieved of the rates to a certain extent?—I do, indeed.

547. Would there be any chance of that being done?—Not with the present importance attached to the subject.

548. The subject would have to be brought more prominently forward first, you think?—Yes.

549. (*Sir John Rolleston.*) Except rabbits, there is not anything else that people shoot which hurts young plantations, is there?—There are hares, but, of course, they do not matter so much as rabbits. It is the destruction of the weasels, hawks, and stoats which, according to my experience, has done so much damage.

Earl of Selborne.

23 Apr. 1902.

550. But if anybody was prepared to have rabbits killed down and not destroy vermin, there is no good reason why we should not have a well-planted estate?—No, not the least.

551. In my experience, the objection landowners, young landowners especially, have to planting is that they do not want to have all their game killed down; but I think it is quite possible that you could have a well-planted estate and game as well; is not that so?—Yes, except rabbits. You mean, have the rabbits somewhere else?

552. And the young cover has very much improved the sporting amenities of an estate?—Partridges and pheasants do absolutely no harm at all—quite the contrary.

553. They make a nice cover in dry seasons, and so on?—Yes.

554. (*Colonel Bailey.*) You said that Mr. Nisbet, who made your working plan, goes down to inspect your woods every year?—Yes.

555. Has he made an inspection yet?—He was there in January.

556. Has he reported to you?—Yes.

557. Do you gather from his report that the work he laid down when he left, after framing the plan, was satisfactorily carried out by the local people?—Yes, on the whole. Of course the inspection is made every year. The first year it was very faulty.

558. Then he has made more than one report?—Yes, three I think.

559. So that the men are getting a little educated in the matter?—Yes.

560. I suppose in the beginning there were considerable defects in their work during the intervals when Mr. Nisbet was away?—Yes.

561. What ages are these woods—are they all ages?—They are all ages. What we start with is a comparatively large area, for a small estate, of mixed copse wood with standard trees in it. The whole of this was big oak at the beginning of the last century, and then it was all cleared in the great war—we are only 24 miles from Portsmouth—and the consequence is that the young oaks are all very much of the same age. Therefore these woods have been very much neglected indeed, and very largely destroyed by rabbits and rubbish allowed to grow up amongst the ash and hazel. Another thing is that the whole value of that kind of property is changing. When I was a boy the best under-wood would sell for as much as £15 an acre every 10 years, but now you will not get £3 an acre for it. The hazel is no longer used for hooping, and hop-poles that used to be the great thing in my country are used less and less, because a permanent system of posts and wires has taken their place. Therefore you want to grow two or three different kinds of things. My object was to gradually eliminate the under-wood and grow more timber.

562. Have any of your woods arrived at the age at which under the plan they would be thinned?—Not from the point of view of reaping the crop.

563. But where the crop is admittedly too dense, have you arrived at the stage where the denseness is about to be relieved by properly conducted thinnings?—No. I have several Scotch firs and larch plantations arriving very near to that.

564. What I wanted to know was, whether your people who had not been instructed in scientific sylviculture were able to carry out such a delicate operation as that correctly in the conditions in which they were working; that is, by the aid of a visit paid once a year to tell them what to do. My own experience is that that is a great difficulty. You said a little while ago that you thought it was highly necessary to educate the landowners, in which I fully agree with you. A proposal has been made that a State area should be acquired, owned and managed by the State, to serve as a practical training ground for students from all parts of the country, I do not say necessarily only one area, but an area or areas, and that this would also act as an object lesson for proprietors, who could see by an inspection of it what the possibilities of systematic forestry are in this country. What do you think of a proposal of that sort? Do you think it would be a useful thing?—I think it would be a very useful thing; I think it would be very good.

565. Do you think that that would have a distinctly

Earl of Selborne.

23 Apr. 1902.

useful effect in moulding the opinion of the land-owning class, and perhaps inducing them to take the matter up seriously?—I think if we could show them in the course of a few years a piece of ground on which an obvious crop was growing which was going to be of real commercial value in bringing a return per acre, such as under no other circumstances that land could produce, that would do more than anything else to convert the English landowner.

566. Can you suggest to the Committee anything that would do better than that?—No. I think that is the very best thing you can possibly do. I think that that, in conjunction with the other suggestions made with regard to education at Oxford and the Forestry School, would be a very good thing. I take it that this would be part of the forestry school.

567. Yes. This forest would be, under the suggestion made, part and parcel of the forestry school; but in addition to educating the students of that school it would also, it is contended, serve as an object lesson to proprietors who have not received any instruction in sylviculture, and who would be able to note and see what was done there. You think that would be a very useful thing?—I think that would be of great value.

568. (*Professor Schlich.*) May I ask what is approximately the area of woodland for which you had a working plan prepared?—I am only speaking approximately, because I have planted a good deal since then. I think eventually—I will put it that way—when I have planted all, it will be about 400 acres.

569. When the working plan was made it was less than that?—The working plan was less than that.

570. And you have arrived at the conclusion that it was a very useful thing to prepare a working plan or management scheme, even for a small area like that?—I did. It serves me two purposes. I had really to change the whole character of my woods. Such as they were they were devoted entirely to growing this underwood, which has ceased to have any commercial value at all. I have had to change this into timber-producing woods, and this working plan has systematised that, and shown how it can be done. It can be done, and it should be done. Then, as arranged in advance, at the time when all the ground has been treated with a view of changing the crop it has to bear, it has provided for its future working.

571. You have already told us that you did not see your way to make such a plan with the establishment or staff at your disposal until you engaged the services of a specialist, who had, as a matter of fact, been trained partly in Germany, and had served for a great many years in India. What I want particularly to ask you to kindly tell us is this. There are a great many people who think that if you let a thorough expert into a forest it will probably make a great deal of difference with regard to the immediate financial results. Under the plan which Mr. Nisbet has made for you, do you think you are worse off financially on your original area than you were before?—You mean worse off already?

572. Yes?—No, not worse off.

573. Do you find that the deficit or surplus, whatever it may be, that existed before, if it was a surplus, has not been diminished?—No.

574. The plan has been made in such a way that you probably get a little more income now?—I think that is certainly true.

575. Did you from the very start?—Yes.

576. That is a very important matter, because there is a great deal of misconception upon that point in this country. Just one more question. Dr. Somerville has already asked a question about the education at the Universities. As most of the landed proprietors go to Oxford or Cambridge, would it not be useful for the landed proprietors, whom you have told us it is most important point to instruct, even if it were not part of the degree, to have an opportunity of attending, while they are at the University, a small course on forestry, so as to get some rational ideas on the subject? Would not that be of great advantage?—A great advantage. It is quite certain that if Oxford and Cambridge took it up it would eventually affect the land-owning classes.

577. If a faculty of forestry were established either at Cambridge or Oxford, or at both, should it not be a part of the duty of the lecturer or professor, whoever it might be, to give a condensed course, just suited to the requirements of those who are likely to have the management of large areas of forests in their hands—would not that be of great advantage?—It would be of great advantage.

578. Do not you think it would be of greater importance than the immediate establishment of special forestry schools for the working foresters?—I do.

579. You hold the view that it is of far more importance to an enlightened proprietor, who has actually to determine the thing in the first instance, than to the working forester. I do not exclude the working forester, I mean to provide for him as well; but what I want to bring particularly out is, that it is of the first importance to give the landed proprietors or their sons some opportunity to have some rational ideas on the subject?—I think that would be a very good thing. By landed proprietors I include, of course, the class of agents and solicitors who manage big estates. If you take a very common case, that is a long minority where the real managers of the estate would probably be agents or solicitors working with the guardians or trustees, they would probably think they were doing their best for the property by letting the shooting with very inadequate, if any, covenancy as regards rabbits, and they would get perhaps 2s. 6d. an acre for 10 or 15 years for as many thousand acres as there are of shooting, and in the meantime the capital value of the woodland might be destroyed or diminished. It would be a far greater loss in the future per acre than the 2s. 6d. would be a gain.

580. That could be to a very large extent avoided if the proprietor himself had a tolerably fair idea of the value of the management?—Yes.

581. (*Mr. Stafford Howard.*) How long has your plan been working now?—Four years.

582. Have you found it at all necessary to vary it in any way since you began?—No, only in small details.

583. At all events the carrying of it out depends a great deal upon yourself?—Yes.

584. If it were not that you were there to look after it, too, a visit once a year of Mr. Nisbet would be hardly enough to ensure it being regularly carried out?—Not if I were not there too.

585. Your bailiff would not be able to carry out a plan like that without your supervision, would he?—No. My bailiff is very interested in the matter, and certainly there is no wilful neglect on his part; but if I were not there he would be referring to Mr. Nisbet, and Mr. Nisbet would have to go down much oftener than he does now.

586. Either he or you must be there?—Yes.

587. (*Chairman.*) I have just a short question or two to ask, if you will allow me. It will probably take some time for private enterprise to make much advance in dealing with waste lands. Have you any objection, in principle, to State forests?—No, none whatever.

588. We have had a great deal of evidence that there are perhaps millions of acres which may be successfully afforested, and I suppose that as managers, factors, agents, or head foresters were trained, you think perhaps the State might turn its attention gradually in that direction?—I think it would be a most excellent thing. The machinery exists with the Woods and Forests, and you might begin by forming a real Forestry Department out of that office.

589. In reply to Col. Bailey's question, you regard the object lessons to be given to owners and agents as more essential than anything, and you also agree with Dr. Schlich's proposal of utilising the universities. Would a complete scheme in your eyes therefore be a model school, Forest school, or State model forest in connection with one or more of the universities?—Yes, I think that is the kind of idea I have had in my mind.

590. Do you think that tithes and local rates and death duties are a real bar to plantations?—I could not go so far as to say that.

591. One often hears it said that to introduce commercial woods grown upon the Continental system would disfigure the country. Have you any experience of the woods along the Rhine or the Danube or the Vosges?—Yes.

592. Do you think that those woods are so much less sightly than some of those grown in this country?—No; I think they have a beauty of their own. I do not think you will find the English landowner put that argument

Earl of Selborne.

23 Apr. 1902.

forward if he once thinks he is going to make a good thing out of it.

593. And you think it would be one of the ways in which a country population could be maintained on the land?—I do, most certainly. I think that is a perfectly true point.

594. Are there any other points you would like to give evidence upon?—I think not.

595. With regard to larch disease, would it not be very desirable to have in connection with these model forests plots where experiments could be carried on by the State, showing what trees mix well together, and what cures larch disease, and so on; because the disadvantage of all private experience is that there is no security for its permanence?—None, whatever. The Japanese larch is said to be immune, and I hope it is.

596. (*Mr. Stafford Howard.*) Have you tried any of the Japanese larch?—I have tried it to begin with. I sent for some seedling larch from a nurseryman, and this last year's seedling quotation is 30s. per 1,000.

597. (*Professor Schlich.*) There are several instances on record where the tree has been attacked by the disease. It is no doubt a fact that when we plant the two together the disease first attacks the indegenous plant, but instances are also known where the Japanese has been attacked, but that is rare as yet?—Is the timber equally good?

598. As far as we know with regard to the timber grown in Japan, but what the timber will be like here we cannot possibly say yet. There is, however, every likelihood that it will turn out to be as good here as in Japan, but there is no certainty about it?—Probably you all know it, but I have proved the comparative immunity of the Corsican from rabbits in a remarkable way. If only the Corsican was a safe transplanter its value would be something extraordinary. I planted about 100 Corsicans right in the middle of a small rabbit warren, and the rabbits certainly did not touch 5 per cent. of them.

599. (*Chairman.*) There is no saying what some of these woods may not turn out to be worth when creosoted?—I found the Corsican was a difficult tree to transplant.

600. (*Dr. Somerville.*) You might get over that difficulty by sowing it *in situ*, making the surface, and putting in the seeds?—I have done that, and the rabbits take the young seedlings, though they do not touch the young tree.

601. (*Colonel Bailey.*) In pursuance of the question as to the advisability of teaching the landowner, you have said that your bailiff or agent develops great interest in this subject. It seems to me that he has developed that interest through your having been educated before him?—That may be so. He had been partially educated by Dr. Somerville.

Sir JOHN W. RAMSDEN, Bart., called; and Examined.

Sir J. W. Ramsden, Bart.

602. (*Chairman.*) You have I believe, planted on a very large scale, especially in Inverness-shire?—I have done so.

603. Of which you have given us a most interesting return?—I have given a return.

604. You believe, do you not, that most of those plantations will some day yield a good return?—Yes, some day or other they will, no doubt.

605. You have no reason to doubt the figures of Mr. Grant Thomson which he gave in evidence before the Select Committee in 1887, that the woodlands in Strathspey would return from 7s. 6d. to 10s. per acre?—I have not seen those returns, but I should certainly put absolute faith in any figures that Mr. Grant Thomson gave, because I believe he is practically the best authority on tree planting and forest management that I have ever had to do with.

606. As you say, you have been very fortunate in your local management in Inverness-shire; but do you think if you wished to recommend the names of three or four young active foresters, well trained, to friends for employment there would be any difficulty in finding them? Are there any thoroughly trained foresters?—I personally could not find one myself.

607. It is very hard to find well-trained foresters?—I could not myself find one. I should apply to Mr. Grant Thomson, and ask him to do it for me. I fancy that even he would have a difficulty in finding one.

608. Do you think it would be desirable to have some facilities provided by the State for the forestry training of landowners, land agents, and foresters?—Undoubtedly.

609. You have some interesting figures regarding the tithe on your Bulstrode estate. Are these a heavier burden even than the rates on the plantations?—They are very heavy indeed.

610. The tithe is a very heavy burden?—Yes, the tithe I think is heavier even than the rates and the income tax. I think you will see that the tithe is the heaviest of all.

611. And you think that these charges are a serious handicap to plantations?—Yes, I certainly do think so.

612. You are trying a great number of the new conifers, are you not?—Yes.

613. Do they do remarkably well?—Some of them grow with extraordinary vigour, particularly the Californian ones, the *Picea nobilis* best of all.

614. And they grow to a considerable altitude, do they not?—None of mine have been planted for more than thirty years. The *Nobilis* and the *Douglasii* grow quicker than any trees I have ever seen, quicker than any trees in England.

615. Your Inverness-shire woods will some day require a very extensive system of facilities for getting the wood away from the felling areas?—Yes, they will.

616. And for all that kind of work, as well as for planting, it is desirable that foresters should have a good theoretical training, so as to be able to put the wood upon the market with the least possible expense?—Certainly, particularly in those out of the way places like Inverness-shire. Take mine, a good deal of it is seventeen, eighteen, or twenty miles from a railway. To make any profit at all it must be manufactured on the spot, and I believe the calculation is that one-third of the whole weight of timber is cut to waste, as backs and outsides. If you had to cart that extra third twenty miles or even greater distances, that would, of course, handicap the value of the timber enormously.

617. And you will have before long to begin the manufacture of timber in Inverness-shire?—I have not contemplated doing so, because I always considered that would be work for the next generation, but I certainly have now to thin, and I have to leave the thinnings on the ground, because I believe it would cost more to carry them to the station than I should get for them.

618. Your expense of planting, apart from fencing, amounts to £2 12s. an acre?—£3 12s.

619. Yes, with the fencing it is £3 12s., but the fencing is put down at £1 an acre?—Yes.

620. It is really hardly fair, is it, to charge the whole of the fencing to the wood?—Fencing is such a very variable charge; it entirely depends upon the extent that you can plant within one fence.

621. As Mr. Robertson, who used to be my forester, says, the trees have not to be fenced in to keep them on the ground?—No, it is to keep the cattle or deer or sheep out.

622. Do you think it would be a good thing to have State experimental areas and forest schools or model forests where all kinds of experiments in growing and in the utilisation of forest products could be made?—No doubt it would be very desirable, if it were possible.

623. Do you think that practical demonstrations would have more effect upon the ordinary landowner and agent and forester than theoretical instruction?—Undoubtedly so; but the two combined would be better. If you could preach your sermon, and then show on the ground the results, that would be far more effectual.

624. There should be a State forest area or a model forest area in connection with some centre for the theoretical training, or some university?—It would be most desirable if you could do it.

625. (*Professor Somerville.*) I do not think I have very much to ask you, but I would like to get a little information, and a special opinion from you with regard to this particular point. You have a large area of woodland, because I see that in Inverness-shire you have planted during the last thirty years something like 10,000 acres?—That is on one estate, but I have planted another 2,000 acres on another estate besides that.

626. I suppose in the course of 40 or 50 years this area

Sir J. W. Ramsden, Bart.

23 Apr. 1902.

of woodland will come to be worth something like £40 or £50 an acre of capital value?—I hope so; but I have not made any calculation further than that I have always considered it would be of great value to those who came after me.

627. Assuming it comes to be worth £50 an acre, that represents something like half a million sterling?—Yes.

628. In this country I believe the ordinary head forester is sometimes in receipt of a wage of about £100 a year, and as often less I should say as more; do not you think it is hardly what one might call sufficient remuneration for a man who has the responsibility of the management of capital to the extent of half a million sterling?—No.

629. In other words, does not it strike you that the remuneration of the British forester is scarcely proportionate to his responsibility; that he gets such a small wage that he is not encouraged to educate himself up to the great responsibilities he has to undertake?—You pay him really the market rate that his services command. I have never considered that there is half a million lying on the ground; it is a thing so entirely in the future that I have never really looked at it in that light.

630. Do you think that one would get improved management on the part of foresters if there were improved facilities for education in forestry?—Yes.

631. Do you think that education would make the woods more productive?—I should imagine so, but it is merely a sort of a general pious opinion. I cannot speak with any knowledge on the point.

632. Do you think it would be desirable to introduce the study of forestry into our English and Scottish universities, so that young landowners, in place, we will say, of studying law alone, or in place of taking, we will say, history, should at the universities become acquainted, amongst other things, with the principles of sylviculture, so that they may know and take rather a more intelligent interest in the woods when they come to own them?—It would be very desirable, but I am afraid you would have very few who would attend classes on the subject.

633. Do you think that forestry and agriculture would not appeal quite as strongly to the young landowner as, say, history and law?—Certainly it would have appealed much more strongly to myself, but that is a matter of individual taste.

634. When you were at the university, do you think, if facilities had been offered, you would have studied forestry and rural economy generally?—Forestry I think I should have, as I was always very much interested in it.

635. In fact, you would possibly regret that the opportunities were not available in those days, and are still hardly available?—Yes, but I am afraid practically you would get so very few to attend that you could never keep up the professorship.

636. (*Mr. Marshall.*) The Chairman asked you about the rates. I see in this return of the Bulstrode estate that the rates are now very heavy indeed in proportion to the receipts. I think the receipts average for the sixteen years 6s. 9d. per acre, but by the time you have taken the rates and outgoings out you bring it down to 1s. 3d. per acre?—Yes.

637. Is there any possible way of getting the land relieved from rates?—I am afraid not—at least, I do not know of any.

638. Not by getting Parliament to take it up?—Who is to pay them? Somebody must pay them.

639. I suppose the tithe would be very hard to get taken off?—Yes.

640. But it might be possibly represented that some relief could be made in that way, because by this showing of yours it is very large?—It is an immense burden, but I do not see how you can get over it.

641. If something could be done, you admit it would be a great thing for forestry?—It would no doubt, but the owner of the land under wood is probably the owner of a great deal of agricultural land around it, and if you threw the burden off the forest it would be throwing the burden on to the agricultural land.

642. There was a concession made with regard to agricultural land a few years ago when the rates were reduced by half?—If the legislature would include the woodland in that relief that would be a good thing.

643. (*Colonel Bailey.*) I will just put the question asked by Dr. Somerville in a slightly different form. When you consider the very great capital value of woods like your own, might it not be an advantage to proprietors to pay higher salaries to their foresters, if they could get thoroughly well educated and scientifically trained men?—I think it would be worth while if you could get the men.

644. That is my point, if you could get the men?—Yes.

645. In view of the high capital value, the question is whether it would not be better perhaps to spend a higher proportion in the salary of managers if you could get really well trained men?—Yes.

646. It would follow then that it would be desirable to establish some system of training men of that class?—Yes, very desirable.

647. Do you think it would also be a great advantage for the proprietor class to have the means of getting more sylvicultural information than they have at present?—Certainly.

648. If they were first of all instructed, the instruction of their subordinates might more readily follow?—Certainly.

649. (*Professor Schlich.*) Am I correct in thinking that you also own some beech woods in Buckinghamshire?—My wife owns them.

650. But you know something about them?—A little, but not very much.

651. I want to draw attention to a point in a note by you in which you say, "Larch in mixed plantation amongst firs and other varieties seem less subject to disease, and these look vigorous and healthy." Do you remember what those other varieties are—are they all conifers?—That refers to the woods in Inverness-shire, and is a note which was given to me by my Inverness-shire manager.

652. Are they all conifers?—Practically all.

653. You have a certain amount of larch disease even in these mixed plantations in Inverness-shire?—A certain amount.

654. But perhaps not so much as when you plant them pure?—That is his observation. I had a letter from him only yesterday. He had been round the woods, and he reported that all the plantations containing larch (the mixed plantations) were looking very well, and that there was no disease whatever.

655. In some of them?—Yes, in the mixed ones. Unfortunately in these two plantations where I planted nothing but larch the disease seems to have been the worst.

656. In your beech woods in Buckinghamshire has the woodman who manages them for you ever suggested that you should introduce larch in little patches or in single trees into your beech woods?—No, I do not think he has.

657. I want to tell you that, as far as the experience on the Continent is concerned, for instance in Germany, perhaps the only means to grow larch is to put it in small patches, or single trees, amongst the beech woods, dotted over so that they are practically separated by intermediate belts of beech. Larch pays very well, does not it, if it does not get disease?—Yes; I believe better than any other timber.

658. Do not you think it would be a great advantage if your attention had been drawn to the fact that you could increase the revenue from your beech woods by dotting it over with larch?—Certainly, very much indeed. I am very much obliged to you for the suggestion, and it shall be done next year.

659. I am very glad to hear what you say, because I am now going a step further. If we had a sufficient number of men learned or experienced in proper sylviculture it is just possible that many years ago all those beech woods in Buckinghamshire would have been dotted over with a considerable amount of larch, which would have greatly improved the revenue from those plantations?—Yes.

660. Do not you think that would have been a great advantage?—That would be a great advantage.

661. Do not you think well-instructed men of that class would have been of great importance to the proprietor?—Very great.

662. In increasing his revenue?—Yes, of very great importance.

663. Another question is connected with the same subject. You have planted some 10,000 acres, or 2,000 more?—Yes, 12,000 in all.

664. The oldest of these plantations I see is stated to be of 1873. that is just about 30 years ago?—Yes, nearly 30 years ago.

665. So far your plantations have been very successful, have they?—Yes.

666. When you look, on the other hand, at your old woods, do you find that the revenue from your old woods is very small indeed?—Nothing.

667. They have been managed under the usual old system, have they not?—Yes.

668. Now here you have promising young plantations of 10,000 acres which, as Dr. Somerville has pointed out, some day ought to reach a very high value?—They ought to.

669. According to my idea the real time when skilled forestry comes in is just about beginning in your plantation of 10.000 acres. Have you sufficient confidence in the men in charge that they will do the necessary things, so that they may lead to a higher income than what has been shown before by your old woods?—I am afraid I do not quite follow you.

670. Your old woods had hardly any revenue at all?—Nothing, but those are neglected old woods in Buckinghamshire.

671. But they are the result of the management they had in the past?—Yes.

672. Now you have 10.000 acres. Have you the proper men to look after them, now that the critical time is coming when systematic thinning has to be done, so as to be assured that the woods by proper management will be of high value? Have you sufficient confidence that your manager will do justice to that?—I have great confidence in him as far as his knowledge goes.

673. Do you think he has the necessary knowledge?—Whenever there is a doubtful point I at once consult Mr. Grant Thomson, Lady Seafield's manager. He is very kind, and gives me all the advice I need. That is the best advice I can get that I know of.

674. Are there many men like Mr. Thomson in Scotland?—I know no other so far as knowledge of trees is concerned.

675. So that you are reduced to Mr. Grant Thomson?—I am.

676. Now, do not you think we ought to have quite a number of men like Mr. Grant Thomson in Scotland?—I wish to goodness we had.

677. And ought we not to take measures at once to get them?—Certainly. If you succeed in that it would be of the utmost value to us.

678. (*Mr. Stafford Howard.*) What are the woods in Buckinghamshire that you have?—They are neglected old woods.

679. Are they beech, or what?—Some of them are beech, and some oak at long distances that have been cut for generations as under-wood.

680. And you find that the under-wood is not of much value now?—Very little indeed: it is scarcely saleable.

681. It has not occurred to you, as it occurred to Lord Selborne, our previous witness, that it is advisable to make a change in the system of cultivation owing to the very little value of copse-wood nowadays?—I do not know what change to make.

682. If you read the evidence you will find that he has adopted a plan by which he is going to get rid of the copse-wood practically, I understand, and grow high timber, and as these results appear so far it might be worth while to consider that?—I suppose he would have to grub up all the old stools.

683. Lord Selborne informed us that it was paying him better whilst he was making the change than it was before, or at all events he had not lost by it: the income from his old woods was not less than it was before?—I have always considered that to grub up those old stools would cost many times the value of the fee simple of the land, and it was clearly beyond remedy, and that we must treat them merely as ornamental ground.

684. I would refer you to his working plans by Dr. Nisbet, where you can see what he is doing?—Will you publish these in the Blue Book?

685. I can easily send you one if you wish to have it?—Has he printed a memorandum?

Sir J. W. Ramsden, Bart.

23 Apr. 1902.

686. Yes?—I am glad to hear it.

687. I see that whilst your gross receipts per acre were 6s. 9d. you are assessed at 12s. per acre?—Yes.

688. Have you not thought it worth while to try to get that assessment reduced?—I think we did try, but you never do get assessments reduced. The Assessment Committee will not attend to anything of that sort.

689. I suppose one reason for the tithe being so high as 3s. an acre is that some of it is old arable land?—Yes, a good deal of it has been arable land, but that is not where the tithe is so very high. The tithe is high in the part that has apparently been wood from all time.

690. There is one wood where there is no tithe at all?—Yes, that is a beech wood.

691. How do you account for that?—I cannot account for it. There is a wood of large extent called the Duke's Wood, where the tithe is heaviest. I do not think it is sub-divided in that return.

692. Do you consider it would be reasonable that when relief was given to agricultural land it should have been extended to woods as well?—I think that might have been done. It would no doubt have been a great relief: it would take off half the rates.

693. Are you troubled with rabbits at all?—I keep a man on purpose to keep the rabbits down, to exterminate them as much as possible.

694. And you are strongly of opinion that rabbits are quite incompatible with making woods pay?—Absolutely.

695. Do you think that the shooting rents that some people get are equivalent for the damage that rabbits do?—No. In my shooting agreements in Scotland—and of course most of the land is let for shooting—I always reserve power to destroy hares, rabbits, roe deer, and squirrels. I do not know which is the most mischievous.

696. At your discretion?—Yes.

697. Do you give notice to the tenant that you intend to do it?—No, in Scotland I do not. I reserve power to do it, except when he is residing there, which is practically during August and September; for all the rest of the year I keep the power in my own hands.

698. And you think it necessary to reserve the power in your own hands?—Absolutely necessary.

699. Have you ever sent your foresters to see what is going on on other estates?—Only to Lady Seafield's estate.

700. You have not thought it worth while to go round to other large estates and see what may be done?—Are you speaking of Scotland or of England?

701. I am speaking of Scotland, but it will apply equally well to England?—My manager was sent to me by Mr. Grant Thomson, and has always sat at Mr. Thomson's feet, and I have always sent him back to Mr. Thomson for any information he might require.

702. You think there is nobody he can get more information from than Mr. Thomson?—No, I think he is the best practical authority in Scotland, and I have never gone beyond him.

703. Some years ago we took some of our foresters from the Forest of Dean to France, to see the system there, and we found it had an immense effect in the interest it gave them, and the widening of their knowledge. I should think that even visiting large estates in England, where you know woods are well managed under a competent forester, might give a great deal of experience to a forester of your own?—I do not know of any well-managed woods. I should be glad if you could tell me of them.

704. I was told by a very well-known forester, Colonel Pearson, that he considered forestry was a science that came by observation. Do you not think that the more observation you get of different places the better your knowledge will become?—No doubt it would be desirable, but I really do not know anybody who does pay much attention to their woods in England.

705. Do not you think it would be an advantage to learn from the faults of other people?—I think it would take a man a good deal of time, and I do not know whether then he would learn much from them.

706. You do think a State forest or a model forest, where there would be a school that people could go to for a long time or a short time, would be a great advantage?—If you could have one where a young man training for a forester could go for a year, or something of that sort, and combine the practical planting and

Sir J. W. Ramsden, Bart.

23 Apr. 1902.

pruning of trees with the theory, it would be of great advantage, I think.

707. He ought, in fact, to be regularly employed as a forester under proper supervision?—I think that would be the best.

708. Do you think that would be a great advantage to the foresters of this country?—A very great advantage.

709. If such an establishment as that existed it would be an advantage?—Certainly.

710. (*Professor Schlich.*) You have planted, according to this statement, some 10,000 acres; would you kindly tell us how that land was used before it was planted?—It was partly under deer, and the rest was under sheep.

711. Have you any idea what the land was worth before you planted it—the income derived from it?—Something very small indeed.

712. What would you estimate it at?—I really could not say.

713. Approximately?—It would be such a mere guess, but I could not put it at more than—well, I really do not like to say, because I should be making such an utterly vague shot.

714. Well, can you give us that vague shot?—I would rather not, because I might mislead you.

715. Was it 2s. an acre?—I should say it would not be worth more.

716. (*Professor Campbell.*) Is heather growing on the ground?—On a good deal of it, but some of it is richer land, and grows bracken.

717. And that is the land you have now planted?—Yes. Of course on that extent of ground there is every variety.

718. What is the altitude of the land?—The lowest point would be about 800ft. It is from 800ft. above the sea to getting on to 2,000ft. On anything above 1,500 or 1,600 feet above the sea you merely plant just to make a shelter, but you never expect to see timber.

719. (*Chairman.*) There is only one point that I should like to ask another question on, and that is the wages paid to foresters, of which we have heard so much. There is no doubt that, considering the capital you find upon the land in large woods as compared with the capital in agricultural land of similar value, the wages paid to the wood manager would be considerably less than what are paid to the land manager?—Do you mean less than would be paid to the farm bailiff?

720. No, I would go a little further than that. Supposing you had an agricultural estate of £5,000 a year, worth £100,000, and you had £100,000 worth of wood upon another area of land. The wages of management of the agricultural land would be very much higher probably than the wages of the management of the wood land?—Very much, I should think, because on the agricultural land you would have to do all agricultural operations—ploughing, sowing, reaping, etc., whereas in the woods you simply have occasional thinning. You have not to help the crop in the woods, as it is growing of its own accord.

721. On the Continent the men who would be in charge of £100,000 worth of wood would be quite as highly trained men as the managers of £100,000 worth of agriculture?—If you set up your school we shall be very glad to get the men.

722. As matters stand at present, if the land-owner were to place £100,000 worth of agricultural land under the management of a labourer, at £1 a week, his action would attract public curiosity, but he might place the same man in charge of £100,000 worth of wood without losing his character as a prudent man of business?—Agricultural land producing £100,000 would be a very large affair.

723. I mean £100,000 worth of land, producing £4,000 or £5,000 a year?—The manager of the agricultural land would require to possess much more varied knowledge.

724. That would probably hardly be the view on the Continent, where the forest officers are as highly trained as any land managers?—We are benighted in that way, and I have no doubt your woods would pay very much better if you knew how to manage them better.

725. (*Dr. Somerville.*) I suppose that on your extensive estates in the Highlands you have a large number of sheep farms?—Yes.

726. I suppose that the rents have been coming down very much indeed of late years?—I have them all in my own hands. They came into my hands about 20 years ago. When the leases expired they were all thrown on my hands. I have taken over the whole thing.

727. And you have practically no land let as sheep walks now at all?—Only comparatively small extents attached to arable farms.

728. But at any rate it is within your knowledge that sheep rents have been coming down very much indeed?—Enormously, particularly in the wether farms.

729. That is the higher ground?—Yes.

730. There has been great difficulty indeed in letting sheep farms?—Very great; I should say an impossibility.

731. I suppose that this difficulty of letting the farms is largely due to the fact that the stock is bound to the ground, and the incoming tenant has to pay more for the stock than he would get if he realised in the open market?—Yes. It is notorious that there is a legalised system of robbery in these valuations.

732. Now, the rent of sheep land has almost come to a vanishing point?—Certainly on wether farms.

733. I believe there are cases where a stock of as much as 5,000 or 6,000 sheep is let for a matter of £200 a year?—Roughly speaking, my experience is this: I get nothing at all upon my capital which is sunk in sheep, but the farms just pay their way, and leave me the wool as a rent. The wool is now becoming worth next to nothing.

734. When sheep farms are thrown on the landlord's hands, he has to take over the stock, of course?—He has in Scotland.

735. Do you think that the position into which sheep-farming has fallen of late years, the unremunerative condition of the industry, will induce land-owners to turn their attention more in the direction of using their land for forest purposes?—Unfortunately, you see, there is the loss of the rent. Generally Scotch land-owners are not very well off in the way of money, and when they have lost their rent from sheep they have no money they can use in planting. If they had the money I have no doubt they would turn the land to better account in that way.

736. Do you think that this would present an opportunity for the State doing something to encourage tree-planting, either through the agency of loans under supervision, or through the agency of the State acquiring areas of suitable land and carrying on the business of forestry as a State industry?—Yes. I suppose there has never been an opportunity when the State could buy land in the Highlands cheaper than it can do now.

737. (*Mr. Marshall.*) With regard to the relations between your forester and your head gamekeeper, do you find the forester's operations are much interfered with by the keeper's restrictions, keeping him out of the woods at particular times?—I do not find so in the least.

738. Is he independent of the keeper?—He is above the keeper.

739. (*Chairman.*) Is there any other point you would like to mention?—No, I do not think so.

Mr. A. Slater.

Mr. Andrew Slater, Land-Steward, Osborne, Isle of Wight, called; and Examined.

740. (*Chairman.*) You are land-steward at Osborne?—Yes.

741. You have also had some experience of Scottish forestry?—Yes, in various parts of Scotland.

742. What are your views generally as to the condition of forestry, and the training that is available at present for foresters or land managers? Do you think their training leaves much to be desired?—Yes, I think considerably much to be desired in the way of training young men for managing woods. For instance, there is no place where they can obtain training except at Coopers Hill and the Edinburgh Botanic Gardens, and I do not consider they are able to acquire a thorough knowledge of forestry in that way without practical knowledge as well.

743. You think there is a great need for a model forest to show how woods should be grown?—Yes, and I should like also to have a school in connection with

Mr. A. Slater.

23 Apr. 1902.

the forest. I do not think there is any use having a school separate from the forest; it would be most inconvenient to the men who joined the school, and inconvenient in many other ways.

744. Do you think that many foresters would go to a central forest school, or that they would be best reached by lectures given in different centres? Speaking of theoretical instruction, not the object lesson?—I think the best thing would be to have both combined. It might be worked very much in the way it is worked in the Botanic Gardens at Edinburgh—take the young men who wish to become foresters, train them, and instead of having outside labour on the forest areas, let these young fellows do the work of the State in the forest, and train them in scientific matters as well at the same time.

745. Do you think Edinburgh is a good centre?—Yes.

746. What do you think would be a good centre in England?—I do not know. I should not start with too many schools at once. I would take one to start with in a small way, and allow it to develop as time went on. Afterwards, if they were successful, others could be created elsewhere.

747. What do you think are the present conditions of British woodlands?—I do not consider them in a very satisfactory condition.

748. Do you think it has been shown that they can pay?- All the figures I have given in my statement, I think, show that they have paid. The figures are not complete, simply because I do not know what was taken out of the woods before.

749. You think that with improved methods British forestry would come to rank as a great and profitable home industry?—Yes, providing proper land was planted. Of course, if land was of too great a value before it was planted it probably would not pay.

750. Do you think there is much waste land in Britain that could be profitably planted?—There is a great amount of waste.

751. A large amount?—A very large amount, both in England and Scotland.

752. Do you think there is much land in farms, which now returns very little, that could be profitably afforested?—Sheep farms, certainly.

753. Are not there a great many arable farms that do not pay a rent on their fixtures?—I do not know. I should not care about planting land of any great agricultural value.

754. Not, at any rate, when it is once properly cleared?—No. If you plant land at too high a rental it of course cannot be expected to pay in forestry.

755. Do you find foresters as a rule keen for opportunities for a thorough training?—I think so—at least a number of them are.

756. How far is the average head-forester in this country competent to manage his business? Does he know how to deal with the manufacture of timber? Can he tell you what amount of timber there is on the ground, what it costs for haulage and transport, and for cutting it up?—I think most of them have an idea of that, and how it should be done.

757. But they would be none the worse for a thorough training?—No, in scientific matters. I think they know all their practical work very well.

758. You think they know their practical work very well?—Yes.

759. Do you think they know their planting well?—Yes, but they require to know the scientific part as well.

760. Do you think they know the manufacture of wood as well as they know the planting of it?—Most of them do, I think.

761. Do you think they know, as a rule, how many cubic feet of timber there ought to be on a given area of land?—I do not know about that.

762. Or whether there is too much or too little wood on the land?—No, I do not think they understand that part of the matter.

763. There would have to be other facilities for training them on points of that kind?—Yes. These are the points on which mistakes are made: having too little on the land, and too much thinning.

764. A State model forest, or forest in connection with a school—a demonstration area—I suppose ought to be on a site where every kind of demonstration could be given?—Quite so.

765. It is very important, I suppose, to have a thorough course in all forms, not only of growing timber, but of utilising forest products?—Quite so.

766. Is the practice of planting woods carried to a great extent in this country?—No, I do not think so.

767. Do you think many owners and agents know much about the practical working of their woods?—I am afraid not.

768. (*Professor Campbell.*) You say that foresters know their practical work very well?—Yes.

769. I suppose they are all agreed as to the manner in which the practical work should be performed?—I think so.

770. They agree among themselves very well as to methods?—Yes.

771. You are of opinion that they require further training?—Yes.

772. And you are also of opinion that that training should be given in a practical school?—Yes.

773. Now, if you wanted to engage a forester, how many years would you like him to have been in that school before you engaged him?—Supposing he had had a training before he went to the school, a practical training, it would be very much better, and probably then a couple of years at a school would do.

774. You prefer that he went into an ordinary wood first and worked there, and then went to school afterwards?—I think it would be better.

775. Supposing that a young man of 17 could find employment in a State forest, where there was a school attached to it, would you prefer that he should go there first?—I think I should prefer that he had a training before he went, so that he could better understand what he was being taught.

776. Have you any special reason for saying that?—I was acquainted with practical work before I went there, but I should probably be better able to pick up matters in that way which were taught there than if I went there not knowing anything about it.

777. But you want the young forester who goes there to know practical work, do not you?—Yes, and scientific work as well. Of course, it would be of great benefit to these young men—who are probably not very well off—that they should not have to pay a high fee and keep themselves as well if they went to these forest schools. If they could be paid wages and be taught at the same time it would be better.

778. We will assume they would be paid for their work; they would be working men. In such a case you would prefer them to go first to the forest school?—No.

779. You distinctly prefer them to be taught at home first?—I think so.

780. Is that because you have any doubt as to the character of the instruction to be given?—No, I think they would be much better trained outside. Afterwards they could probably see something they could not see outside in the work at the school.

781. Two years, you think, would be sufficient?—I should think so.

782. You have mentioned the training at the Botanic Gardens in Edinburgh; can you tell me a little more about that?—I do not know much about that. Of course, they cannot get much practical training there, because they have not a proper area. There are no woods there, but only a few trees in the grounds.

783. Would you approve of training the landowner, or the agent, or the forester more highly?—The landlords and agents might be trained in the principles of sylviculture, and the forester in these and the practice as well.

784. In England, as a rule, is it the agent that takes the management and supervision of the estate?—Large estates have foresters, but, of course, the forester is under the supervision usually of the agent on most estates.

785. So that it is really the agent who is the prime mover in all matters relating to forestry?—Yes. He would be consulted by the forester as to the clearing, planting, and other such matters connected with the forest department, and, of course, sanctioned, or otherwise, by the landlord through him.

786. Therefore it would be the agent whom you would educate?—Yes, in the way I have stated; but, of course, the agent has simply the supervision, and not many of them interfere with the forester.

787. But it is of the highest importance that he should

Mr. A. Slater.

23 Apr. 1902.

be educated?—Yes; as he has the management of the estate it is desirable he should know, from his own knowledge, whether matters are being carried out properly or not.

788. And you would educate him rather more highly than you would educate the working forester?—Yes, in the scientific details, so that what knowledge the forester might lack he might be able to apply.

789. But you would provide instruction for both?—Yes.

790. (*Professor Schlich.*) You are directly connected with the management of an estate or estates?—An estate.

791. The value of this estate, as I find, you have estimated with compound interest 3 per cent.?—No.

792. But what about this table that you have given us?—I have worked this out from certain tables.

793. So we all do—so do I. But what I want to bring before the attention of the Committee is this: that you have given here (*Appendix V.*) an example of 40 acres of mixed larch and fir, which I suppose will go on our records as an appendix. You state that the land would be scarcely worth 1s. per acre?—Yes.

794. And you have been even so generous and so liberal as to enter into your calculation 2s. per acre?—Yes, including expenses.

795. I beg your pardon. You mean that 2s. would cover the rent and the annual expenses?—I think so—1s. would cover the rent, at any rate.

796. You put the initial cost at £3 10s. per acre?—Probably it did not cost that. I could not tell you what it cost, because that was done long ago.

797. But you think that would cover it?—Yes, more I think, because 60 or 70 years ago things were done very much cheaper than they are now.

798. I am sorry to say I have not checked your calculations, but I have not the slightest doubt they are correct. You show that the result of this 40 acre plot, calculating with 3 per cent. compound interest, would be equivalent to an annual rent of 6s. 2d.?—Yes, that is for the forest-rent. The 2s. ground-rent is allowed for in the calculations; that is an additional rent of 6s. 2d.

799. As a matter of fact, if you had not taken the 2s. out, you would have had an annual rental of 7s. 2d., if you had not charged the 1s. rent?—Yes. This 6s. 2d. is brought out by discounting the profit down to the first year.

800. It would be practically profit, after paying a rent of 1s.?—Yes.

801. So that practically your land would have returned you 7s. 2d.?—Yes.

802. May I ask why you chose 3 per cent. interest?—It was a fair amount of interest.

803. It was a reasonable amount of interest to charge, you think?—Yes.

804. Now comes my question. You know that the Government can borrow at 2½ per cent.—have you ever tried a calculation at 2½ per cent.?—No, I have not done so.

805. I have not had time to do it. Have you an idea of what it would come to if you took your money out of consols, or you did business with money borrowed by the State at 2½ per cent.? Do not you think it would come to double what you have put down here, say 12s.?—I do not think that it would affect it so very much, because the expenditure is treated in the same way as the income.

806. It would make a very great difference?—I can work it out.

807. However, you are satisfied that land of that class can be made to yield an annual rental on the soil of 7s. 2d.?—Yes, probably more than that under proper management.

808. With 3 per cent.?—Yes. Of course part of that is only assumed. Previous to 1884 I do not know what was taken out of it, and I assumed there was £1,500 worth taken out before, and probably a considerable amount more than that was taken out.

809. That is not essential with regard to the point I am driving at. You are convinced that this would give a considerably larger rental on the land than if the land had been kept for its previous purpose, and yielded 1s. an acre?—Very much more.

810. In fact you say seven times more?—Yes.

811. If it were 2½ per cent. it would be probably 12 times more, so that really with land of that class, surplus land, it would pay the State to invest money in it?—Yes, undoubtedly.

812. You have no doubt about that?—No doubt whatever.

813. They would really get more than 2½ per cent. according to your calculation?—Yes.

814. You are satisfied about that?—Quite satisfied.

815. (*Colonel Bailey.*) Of course you know very well that there is a feeling that the system of management hitherto pursued in woods in Scotland is not exactly what it might have been?—I think that is so.

816. People are beginning to think, a good number of them at any rate, that it is not quite rightly done?—Yes.

817. Do you think that that opinion has been extended recently; do you think that a few years ago, say 20 years back, the feeling was different from what it is now?—Yes.

818. Do you think that a considerable number of these men in whose minds that feeling prevails, have a desire for instruction in scientific forestry?—Yes, I think so.

819. You think there are a considerable number of foresters in Scotland who would be glad to avail themselves of instruction in scientific forestry?—Certainly.

820. And you think the desire for that instruction has developed in recent years?—Ten or fifteen years.

821. Have you ever thought what the reasons are for that development?—I think perhaps there have been more publications on forestry lately, and they begin to see from these publications that they have not been working on proper lines. They see also perhaps, from the system that is pursued abroad, that their system entirely differs from that.

822. A great many of your friends and acquaintances have been with the excursions of the Arboricultural Society to see the woods in North Germany?—Yes.

823. You were one of those yourself?—Yes.

824. Do you think the few days they spent in those woods awakened their interest on the subject?—There is no doubt about that, I think.

825. And that would probably be one of the causes for the change of opinion?—Yes, that is one, and a strong one, too.

826. Does that circumstance lead you to think that if the State had a model forest in which things were properly done, and which might be visited by such men, the educational benefit would be considerable?—Yes.

827. Do you think that if an object lesson was provided for them that would be a great national benefit?—Yes, it would be.

828. (*Sir John Rolleston.*) I think you said that your experience was like that of Lord Selborne, that landowners as a rule took very little interest in forestry?—I did not say that. I said they did not know much about forestry. Of course there are a great many landowners who take a deep interest in forestry, although perhaps they do not know much about it, or how to carry out a system.

829. You think as a rule that the landowners are interested, and would like an opportunity, if they could get it, of becoming acquainted with it?—I should think so.

830. I do not quite know myself how you are going to instruct the landowners at any of these colleges. It seems to me that the agent or factor, or whatever he is called, is the most important person to instruct, because he exercises influence over the landowner. Is not that so?—Yes; but of course landowners who wish to take an interest in their estates can easily take a course at some of these places, so that they can get a proper understanding of forestry. It is a most interesting occupation.

831. And it is most desirable economically that the study should be encouraged in every way?—Yes.

832. (*Mr. Marshall.*) You mentioned that the foresters who have come under your observation were fit to undertake the practical part of the work in woods?—Yes.

833. What about the supply of foresters?—Could you to-morrow, or at any reasonable time, get a young practical forester to work in the woods?—Yes.

Mr. A. Slater.

23 Apr. 1902.

834. That does not coincide with my experience. I have been trying for over a year to get men to work in the woods, and I have advertised in the papers, and done all that I possibly could. I only want a practical man to cut down a tree and work under me, and I cannot get that class of man?—I think you should have no difficulty in getting him.

835. I had lately to go to Bristol to get one. Now, with regard to the supply of woodmen to work under a forester, have you a good supply? If you wanted 20 men could you get them?—Perhaps not on the spur of the moment.

836. Supposing more was done in the way of forestry, and a little higher wages were paid than are ordinarily paid to the agricultural labourer, there would be no difficulty about the supply; you could get plenty of men?—I think so. I have had no difficulty in getting men for that sort of work. I am talking of ordinary labourers.

837. In what part of the country?—In the North.

838. In this interesting statement you gave about the 40 acres of larch, can you tell me about what the price per foot of the larch and spruce was?—At that time part of it was sold very cheaply. It was afterwards we got a better price.

839. I mean for your two main lots?—Fully 1s. a foot.

840. And the spruce?—That would be cheaper, about 2d. or 3d. at that time. But that was very coarse stuff.

841. (*Dr. Somerville.*) You have taken a great interest in the development of forestry education?—I have.

842. And you have taken an active part in the movement that has gone on during the last 12 or 15 years?—Yes.

843. I think you yourself have given lectures on sylviculture to a class at the Botanic Gardens in Edinburgh?—Yes.

844. You had not, I suppose, the same opportunities in early youth of getting a technical education of a scientific character in forestry?—No.

845. Do you regret the lack of these opportunities?—Certainly I do.

846. And you consider it is the duty of the State, or of some other body, to provide these opportunities now?—Yes.

847. Do you consider that some such system as this would meet the demands at the present moment, that in those institutions for educational purposes to which young landowners resort they should have the opportunity of studying what we will call the principles of sylviculture?—Yes.

848. You would not consider it very desirable that young landowners should actually themselves go through a course of training in the operation of planting with a spade?—No, I do not mean that.

849. They require in fact to be instructed in the broad principles of the subject?—Quite so.

850. And you consider then that these principles could be properly instilled through class-room instruction?—Yes.

851. In fact, you think that if such facilities were provided at the universities and at the agricultural colleges, it at any rate would, to a large extent, meet the wants of the landowners, and the prospective land-agents??—Yes, I think that is quite right.

852. You, I think, would like to see a practical forest school or schools established with illustrative woods in the neighbourhood?—Yes.

853. You would not in that case dissociate science from practice?—No.

854. It would be then, I suppose, sufficient for the young men who went to these schools to put in a certain amount of practical work, so as to earn wages enough to cover the cost of their instruction?—Yes.

855. They would not be men who could pay anything like £20 a year out of their pocket for instruction?—No.

856. But they would be glad to take advantage of it if they could get it, through their work, as it were?—Yes.

857. You know, of course, about the forestry education in Edinburgh through the University and the Botanic Gardens?—Yes.

858. I suppose during the time you were lecturing at the Botanic Gardens you often found the want of some demonstration area to which you could go with your class, and say, "Now then, I have been lecturing to you about under-planting, or about the mixture of shade-bearing and light-demanding trees, and so on, and there you have actually before your eyes the plantation showing these mixtures." Do not you think that many young foresters who may read books about forestry actually have never themselves had the opportunity of seeing the principles practised which they are reading about, and do not you think a demonstration area would be a proper place to have these principles practically illustrated on the ground?—Yes.

859. You have given us a very interesting example of the financial aspect of forestry, that land has been raised in value materially by being utilised for tree planting. Is there any such area as that within 1½ hours of Edinburgh?—Yes, within an hour of Edinburgh.

860. Was this particular illustration of yours taken from plantations within something like one hour from Edinburgh?—Yes.

861. And, in fact, such land is actually and positively available within an hour of Edinburgh, where the land is not worth more than 1s. an acre, and which has been so materially improved by sylvicultural operations?—I did not say that. That particular area was not worth more than 1s. an acre, but there are other areas in the neighbourhood worth from 1s. to 2s. 6d.

862. Still, Edinburgh, you would consider a first-rate centre for the development of scientific forestry combined with a demonstration forest within an hour of the city?—I do not know that I would put it in that way. I would rather have the school in the area, so that there would be no expense of travelling to and fro from the school to the forest.

863. We agree with you in that: you would have the school on the area, but it would be desirable, would it not, that this area should be still accessible to those attending the University classes?—Certainly.

864. And all within an hour of Edinburgh?—Yes.

865. (*Chairman.*) I am afraid that at present the Government can hardly borrow at 2½ per cent., but I suppose, in addition to the actual interest on the money, there would be expenses in connection with the supervision of the plantations which had been formed with the aid of State loans—the State would have to keep an eye on the management of plantations which it had encouraged by loans?—Yes, in some way, unless it handed it over to the authorities connected with the school.

866. But in any case you could not give loans of public money to private estates without taking ample safeguards that the money was not being thrown away, as it is in so many of the plantations which we know of?—Yes. It is not likely that an area could be got altogether entirely adapted for forestry; there would be probably farms on the area as well.

867. I was speaking of the encouragement of plantations by private owners by the aid of State loans?—I think they advance money for that purpose now.

868. It is taken advantage of?—I do not know whether it is taken advantage of.

869. Have you ever head of its being taken advantage of?—No, I have not.

870. I was asking you about foresters' knowledge of certain parts of their profession. Do you think that thinning is well understood in this country?—I do not think so. That is where great mistakes are made.

871. Foresters do not beleve in dense growth, do they?—No. That is a mistake which is made, and the trees grow up rough and coarse, and not fit for structural purposes.

872. Do you believe in woods being managed under a methodical system, according to fixed forest plans?—Yes. bably the new forester would upset every thing that Of course when a landowner changes his forester, pro- the previous forester had done, and they are frequently changing. Where proper work has been done, on a proper plan, the managers could not alter the system.

873. The management of wood land on an estate is liable to be changed, not only through change of owner-

Mr. A. Slater.

23 Apr. 1902.

ship, but through change of factorship, or change of forester?—Yes. If the working plan was adopted that of course could not be done.

874. Is there any other point you would like to make a statement upon?—I would just like to say that by the acquisition of a forest area, in addition to the benefits that would follow as an educational and training centre for young men, it would also prove of great value as an experimental station, as well as where investigations could be methodically entered into as to the causes, and prevention of, the diseases to which forest trees are subject.

Mr. W. B. Havelock.

Mr. WILLIAM BREWIS HAVELOCK, Forester to the Earl of Yarborough, Brocklesby Park Estate, Lincolnshire, called; and Examined.

875. (*Chairman.*) You have had a long experience of forestry in Lincolnshire and Yorkshire?—Yes.

876. And I believe you have found it possible to make forestry pay?—Yes. I think so. I have had the good fortune to be upon well-wooded estates.

877. Are you much troubled with game?—Not on the estate where I am at present; but I have been where there is a good deal of game.

878. The trees have had a fair chance at Brocklesby Park as regards game?—Yes, an extra good chance. There has been no expense spared for wire netting, and in many cases it has not been necessary to net at all.

879. You have also had to do with the utilisation of forest products; you have done some saw milling?—Yes, but not much sawing for sale. All the sawing we have done has been consumed on the estates or sold to the tenants at a reduced price.

880. Is the creosoting work carried on on the estate?—Yes, we can use all that we can creosote. I think we are able to use more than we can creosote.

881. Do you find that you are able to produce high qualities of timber fetching a high price?—The very best timber I have seen anywhere, both in Yorkshire and in Lincolnshire.

882. Both hard woods and conifers?—Yes; the best larch in England I should say grows on the Duncombe Park Estate in Yorkshire, and I should say some of the best ash in England grows in Lincolnshire. The Lincolnshire ash is very well known.

883. I suppose you find that under your management the net profit to the estate of the woodlands has been better than the net profit upon the agricultural land when you take into consideration all the outgoings?—Yes, taking into account the buildings and the value of the land, and comparing the original value of the land. As a rule the plantations are on the poorest land. In regard to the estate I am on, I cannot exactly say, because the plantations were probably originally planted for shelter, appearance, hunting, and game purposes. But on Lord Feversham's Duncombe Park Estate, there is hardly any woodland upon level ground. It is nearly all upon hillsides and impossible to cultivate, and worth hardly anything for sheep grazing. It is worth very little indeed.

884. At Lord Feversham's you were not entirely clear of game?—No.

885. Supposing you had been free of game the return would have been even better, would it not?—Yes, but game did not affect the old timber when the trees were first planted. When the trees were first planted, according to the traditions of the old woodmen who were living when I went there twenty-three years ago, if the first Lord Feversham saw a rabbit anywhere when he was riding about, if he did not see the head-keeper himself that night he sent someone to see him, and that keeper had to be there next morning, and that rabbit had to be caught. I have told that more than once to the present Lord Feversham, and I may say he quite agreed with it.

886. He has not always followed the practice himself?—He is a keen forester himself, and has tried to do both, *i.e.*, grow both timber and game. There is no expense spared in wire netting on either estate, but I consider wire netting to be a delusion.

887. Do you regard the extreme preservation of game as being the chief obstacle to the growth of timber in this country?—Yes, it is the chief obstacle. It discourages both the owner and the forester. The damage is forgotten in the course of three or four years by everyone but the forester. The rabbits will do so much damage now, and it is not taken seriously into consideration, but after two or three years have gone by many trees are found to be dead.

888. Is there a tendency to fence off parts of the estate where rabbits are kept from the rest?—I have not had any personal experience of that, although I have seen it.

889. Taking England all over, I suppose there is a pretty fair sprinkling of rabbits in the country?—Yes. Even on the farms where the tenants have the power of killing the rabbits.

890. Apart from the game question, do you think there is a great need of a good demonstration ground where you can show what mixtures would do best, how to plant different kinds of trees, and the results which follow different methods of planting trees, and the best methods of preparing timber for the market, getting it there, and manufacturing it?—Yes.

891. When you say there is a need of a suitable forest managed on economic sylvicultural principles, where owners, agents, and foresters can have an object lesson on how to grow to pay, you mean, do you not, that you would have a demonstration forest where every practice connected with forestry and the manufacture of timber might be carried out and shown?—Yes, I am very strongly indeed of that opinion.

892. Do you think that object lessons are more valuable than theoretical training?—I think they are twenty times more valuable; I know that from my own experience.

893. People want to see a thing?—Yes. I remember the first time I went to Castle Howard Estate and saw a plantation of young oak there; twenty years ago I had never seen young oak grown like that before, and I never forgot it. I tried to do the thing myself, and the young oak plantations in Yorkshire, when they grow up, if they get the chance, will probably be as good. I saw it could be done by careful management, and I have endeavoured to do it. That is twenty-three years ago, and I never forgot what I saw then.

894. And you found you could derive special advantage from having seen this?—Yes, that is just one instance out of many.

895. And you would like to see that done with all kinds of trees?—Certainly.

896. In the same way by having plots of land laid out for different kinds of trees, when the clear cut comes at different ages, and if properly done, it would prove that so much land had returned so much clear profit?—Yes.

897. And nothing else will make a great many people believe that woods will pay, I imagine?—No; nothing will do it but that. It is a very difficult matter to get proper book-keeping. You know, sir, I daresay, from your own experience, that that is so. At Brocklesby we keep very strict books, and put everything under its proper head, but even then there is a multitude of things put on the woods which have nothing whatever to do with growing timber. For instance, take the wire netting. I have argued the question with the present Lord Yarborough and his agents, and asked them why the woods should pay for the wire netting. Wire netting does not make the trees grow any better. I have also asked them, why should the trees pay for the fencing. There is not a yard of fencing round the woods for which the woods have not to pay. You do not go on to a single farm and find all the fencing belonging to that farm. If there is any small expense, and they do not know where to put it, if one does not watch the clerks in the Estate offices, they will put it on the woods.

893. The fences are in no case required for trees unless occasionally along a public road?—No, they are not. As a rule in my experience they are all charged to the woods.

899. And what about the roads?—All the roads in the woods are charged. That is another great grievance with me as a forester. I feel very deeply about these things, because we hear so much said about forestry not paying. With regard to the roads, we have to keep the roads in many of the woods fit for driving a carriage and pair on them. It is not only a road necessary for moving the timber over, but broad well-kept

roads or rides running through the woods, charged to the woods. I did not see that in Germany. Going through the woods in Germany in a carriage and pair you had to sit back and hold tight in a great many places, or you would stand a chance of being thrown out. There, woods are only planted for timber, and if the roads will carry the timber that is all that is expected of them. But we have to keep roads and rides level and in good order, and fill up the rabbit holes, and the whole expense is debited to the woods.

900. Do you know the gathering grounds of any of the great Corporations where they gather water for their water supplies?—I know some of them in Yorkshire. I am rather interested in one just now for the Harrogate Corporation on Lord Masham's estate. I know it very well.

901. Do you know that Dr. Schlich and others have shown the extra amount of water that can be obtained in the gathering ground by its being cultivated by trees?—Yes, I have read of that.

902. Is there much tithe and local taxation charged to your woods?—Not much tithe in the woods I have to do with at present; as far as I know most of the woods would not be tithed very highly. But I often think they are rated at per acre really more than the land is worth. I believe the woods are rated at 10s. an acre all round, and the land is not worth it. I am just speaking from recollection, and that is subject to correction. I could easily get the exact figures.

903. Would you advocate the total abolition of local taxation on wood?—I am hardly competent to give an opinion upon that matter.

904. For instance, it occurs to me that you might have a parish in the Highlands altogether under wood, returning a very large rental and maintaining a large population working the wood, and in that case to provide the local taxation it would be necessary to have some powers of rating?—Yes.

906. In the woods that you have managed, have you made them readily accessible for the removal of timber—I mean with regard to roads?—Yes, that is the first thing I consider if it is a new plantation, namely, to make suitable roads, although it is not always necessary to do that. But I prefer to make the road first.

906. Is that a provision that is usually made in English woods?—According to my experience it is.

907. They are pretty well laid out for getting timber from the felling areas to the market?—Yes. The roads that I have to do with at present are remarkably well laid out for that.

908. Do you use traction haulage?—Yes, and have done so for the past eight years.

909. Do you find that is very economical?—Yes; it is the best thing that has ever come upon any estate.

910. We have had some evidence, but according to that evidence it is not common?—I know five or six places that have traction engines. The Duke of Northumberland has them, and so has Lord Cadogan; he has either bought one or is on the point of buying one; and there are other gentlemen I have heard of.

911. Do you think that the sale of timber is much handicapped by transport charges and railway charges?—Railway charges, yes. I will give you an instance of transport, which is only part of the question. Until Lord Yarborough put down his creosote plant eight years ago, we sold the great bulk of the Scotch fir and spruce. We have both, although we have not a great quantity on the estates, because the land will grow something better than those timbers. The timber leader used to get as much per cubic foot for leading the timber from the wood to the station, which took him one day, as Lord Yarborough was getting for growing that timber for nearly 80 years. We were getting 2d. and 2½d. a foot, and it was costing nearly that for getting it to the station. The railway charges to the Midlands, where the timber was chiefly used, were 4d. to 6d. per foot. That was one of the arguments I urged upon Lord Yarborough to get him to put down a creosoting plant to creosote the spruce and fir. It was necessary to have the creosoting plant to be able to use the cheaper sorts of timber at home, and creosoting produces most excellent results. If you were to take and examine the spruce posts that were put down eight years ago you would find them to all appearances as good as when they were put down. If they had been put down uncreosoted they would not have lasted two years.

912. Did they take the creosoting?—Spruce takes the creosote worse than any timber I know. I have the creosoting book here, and I will put it in for you to see.

913. A proper experimental demonstration area, equipped for all purposes, ought to show creosoting and transport just the same as the growing of the wood?—Yes.

914. And you find that you effect considerable economies?—Yes, but it is difficult to show them in actual £ s. d.—difficult to show what these savings are. You cannot make a balance-sheet and show you have spent less or bought more in; and if you cannot show it in that way you cannot get people to believe it. If you can show them in actual cash on one side or the other they believe you; but if you begin to work it out and say that if you had not used this creosoting plant and had used oak, larch, or even ash, it would have cost so much more, they do not seem capable of taking that in. They look more to the annual expenditure and compare one year's expenditure with another year's expenditure, probably forgetting in the meantime the extra work you are doing.

915. In the mere matter of transport by traction or haulage it is easy to show what the saving is, because you can show the old carting bills with the cost of the traction and the staff?—Our traction engine is used entirely for work on the estate; we should require another one for hauling to the station.

916. Have you found foresters keen to acquire knowledge? Are many of your men anxious to push on and get a good training?—I have come across a good many.

917. You think there are plenty of foresters who will take advantage of facilities for mastering their profession if they have opportunities for doing so?—Yes, if they can afford it. At the present time I have the offer of two young fellows who desire to come to me. If they could go to a forest school they would not go to a forester. I have had two or three people before as pupils.

918. Do you think that all classes connected with timber growing, the owner, the agent, and the forester, equally need training?—They all equally need training, but I really think the forester knows most about it of the three, as a rule. Land agents, as a rule, have not had the opportunity of studying forestry, and not many of them perhaps profess to know it.

919. Do you find many landowners interested in their woods?—Speaking for the two I have been with, they are very much interested in the woods. There is not much of any importance done on either estate before it is laid before them. They see the whole thing and decide whether to plant or to fell.

920. I suppose many landowners are interested, but their interest ought to be backed up by knowledge to a greater extent, you believe?—Yes; if they knew more they would go more in for it, I think.

921. (*Mr. Stafford Howard.*) How many estates have you been connected with?—I have been head forester on two estates, and I received my training under my father, who was a woods manager for practically all his life.

922. In Scotland?—No, on estates in Northumberland owned by the Lords of the Admiralty.

923. Where were you before you went to Brocklesby?—I was with Lord Feversham in the North Riding of Yorkshire.

924. On the estate where you are at present they have managed the woods carefully for a very large number of years, have they not?—Yes.

925. And kept very careful accounts?—And kept very careful accounts.

926. But on the whole does it show that the timber has been grown at a profit for all the series of years?—I think I can say so, and with Lord Yarborough's permission, which I think I could easily get, I could show that by the books.

927. Has it been more profitable than land which has been otherwise occupied?—I should not like to say that, as many of the woods were planted not for timber, but for effect and shelter.

928. That is usually the case in large estates, is it not?—Yes; the rides are then very wide, which is really harmful and has injured the growing timber.

929. Have you much copse wood there?—Practically none at all.

Mr. W. R. Havelock.

23 Apr. 1902.

930. No copse wood?—Not true copse wood. We think the other pays better.

931. You do not find so much demand for copse wood now, compared to what the demand used to be?—There is a local demand for copse woods to make into hedge stakes and thatch pegs and "tray ties" (a local name used for rods for holding straw to hurdles for lambing shelters).

932. You can always get rid of what you get: there is sufficient local demand for the smaller stuff?—Yes, we never waste any.

933. You were speaking about a visit to Castle Howard when you saw this oak plantation. What particular lesson did it teach you—to improve your plantation?—I saw the distances they were standing apart and the fine shape and condition of the trees. They were beautifully formed trees, long, clean-stemmed, and when they came to be fully grown they would be models of what an oak tree should be, in my opinion.

934. What did you proceed to do to imitate it?—I thick planted to begin with, and also I got a little information from the forester in charge there. I was planting some similar land at Duncombe Park at the time. The young oaks were not growing very well, and I hardly liked to cut their heads off. I was only quite a young man then, and did not care for cutting the heads off the trees without knowing that I was right. But when I heard what had been done to some of their young trees, I came home and had many heads cut off within about half an inch of the ground, and stuck the top in so that the men would not cut the shoots off with the rubbish next summer. I was in that plantation last winter, and I found the oaks were growing beautifully. They were as straight as an arrow. Three or four shoots came away, but we left the best one. The oaks were planted about ten feet apart.

935. Therefore your visit to Castle Howard when you saw what was going on there was a great advantage to you?—Yes, on that particular point.

936. You say the rates are about 10s. an acre?—Yes, the rateable value. They are rated at 10s. an acre, and that is about the average.

937. Do you consider that is above the value of the land?—I think it is above the value of the land.

938. Compared with what crops produce?—Compared with the farming land.

939. I mean what your woods produce. Your woods may produce more than the farming land, and if so they may be rated higher. You think it is unfair considered in relation to the value of the woods and what they produce?—Yes, I think it is. One reason is that I think a great deal of land in the woods is not planted; such, for instance, as the wide drives which you see in the Dukeries, but, of course, that is all measured in the area of the wood.

940. You must take an average for the whole?—I have always thought it was too much.

941. Have you worked out the wood accounts sufficiently accurately to know what you are making, so as to put it before the Local Authority to show it was overrated or over-assessed?—We could easily do that.

942. But you have never tried that?—I was never asked to do it.

943. When you speak of roads being made in new plantations, do you mean roads simply to get about, or real hard roads?—Roads just to get about. I would not make a hard road until it was needed, and it is not often needed except where there is a bog. When roads are needed let the road be made to fetch the timber out, and then level the ruts when done with.

944. Where you have a large area of timber, and you are constantly cutting, it might be advisable to have good central roads?—Yes. I agree with a good central road in a large plantation. I had a plantation like that in Northumberland, which now belongs to Mr. W. B. Beaumont.

945. At Dilston?—Yes. There is a central stoned road in one of those woods, but it was a 500 acre plantation, and this hard road went right through the wood.

946. It makes a great deal of difference as to what you get for your timber whether it can be taken away easily or whether it is only taken away with great difficulty?—Not so much difference as the distance of the station from the woods makes, I think you will find in practice. Timber merchants, if they contract for the leading, as many of them do, reckon that if a team can go once in the day to the station with a load it is worth so much a foot. If it gets beyond a certain distance I do not care how good the road is, he could not go more than once a day. Amongst timber leaders you do not see anyone who lays himself out for leading timber going to the woods with one set of horses. They will have more than that, they will have at least two sets of horses, that is, six horses, and sometimes nine horses. It has to be a bad road in the wood if six or nine horses cannot pull a load of wood out. It must be something extraordinary.

947. Then the distance from the station affects it more than the actual state of the road in the wood?—That is my experience.

948. Do you cut up your own timber, or sell it standing?—We sell it standing by private tender, or felled by public auction, or privately, direct. We have a sale of 28,000 feet at the present moment. I also sell privately to the tenants. As a rule I make it a point to sell it publicly in some fashion, either by tender, standing, or by private tender felled, or public auction. I prefer to do that for my own protection.

949. And do you find the prices improved of late years?—Yes.

950. Distinctly improving? — Distinctly improving. Take larch, for instance, because I have had a considerable experience with larch. Lord Feversham owns a great extent of larch. In a certain wood larch was making 10d. per foot 20 years ago, and the larch in the same plantation to-day—and it has not grown so very much, as it has been ripe for some years—is worth from 13d. to 15d. Larch has risen perhaps as much as anything in timber.

951. Are you troubled with larch disease in young larch trees?—Not much in Lincolnshire, but very much so in Yorkshire. We plant larch pretty freely in Lincolnshire.

952. (*Professor Campbell.*) You are in favour of providing technical education for foresters?—Yes. I felt the need of it myself.

953. You yourself have found the want of it?—Yes.

954. Have you men under you to whom you would like to give a technical training? We do not want to go down to labourers, I presume; you do not anticipate that the school would provide for the labourers? It is for those immediately under you: men who are aspiring to the position of head forester?—I have one or two at the present time, and I have seen young men at various times who wished to take up the profession of forestry, and I have one or two who would like to improve themselves.

955. Have you in your regular employment one or two men under you who want to have a technical training?—I cannot say I have just now.

956. That is to say, you yourself direct the workers? —I act through the foreman, who is a middle-aged man. As a rule they are all married men, and they would not have the education to begin with.

957. If he had been a younger man he would have wanted it?—A few of them, but I am sorry to say that it is the exception in Lincolushire: not many men show that desire.

958. It is a pretty large estate, is it?—We have from 5,000 to 6,000 acres of wood, and the whole estate is about 50,000 acres.

959. So that the technical training required would be for the head foresters?—Head foresters and head foresters' sons. Many of the ordinary working men do not know sufficient to wish to improve themselves.

960. So that the number that is wanted per annum would not be very great?—Not very many, I think. I think there are as many competent foresters in the country at the present time as there are good appointments for.

961. Do you think they are especially well trained?—Yes, I know a good many trained men, but there are no appointments for them.

962. Do you think that if a larger number were trained there would be no demand for them?—Not under present conditions.

963. But if there was a revival of forestry?—If there was a revival of forestry, of course there would be a demand.

964. You mentioned that you occasionally get pupils.

Are these young men who wish to become agents by-and-by?—I have had men come sometimes who have taken up the subject of forestry in order to pass the examination at the Surveyors' Institute. I have had one or two University men come for a time, men who intended to be land agents.

965. How long do they usually stay?—They stay a year, but it is far too little. It ought to be two years at least in order to see everything, and see twice round the year's work.

966. But a well-educated man would learn forestry in two years, you think?—Yes. He would learn a good deal in that time.

967. Do you think on small estates that the forester would readily avail himself of the services of an expert if such were provided for him? Suppose, for example, that a proprietor of a small estate wishes to plant, and he had the opportunity of obtaining the advice of a good expert, would that be taken advantage of by the forester—would the forester be amenable, do you think, to instruction?—I think the younger foresters would.

968. And do you think that the landowners themselves would be very glad to take advice?—Yes, I think many of them would.

969. In fact, there is a great desire on the part of landowners to be able to obtain the use of experts?—Yes, a desire to a certain extent, but I could not say it is a very general desire.

970. It is chiefly on small estates, I presume?—Yes.

971. (*Mr. J. H. Lewis.*) Do I understand you to say that fencing against game is a delusion?—Yes, it is.

972. Do you consider that by this time rabbits have become so artful that no fencing can keep them out?—I do not mean that.

973. Then in what sense do you say that fencing is a delusion?—I am speaking to gentlemen who know something about rabbits, I expect. Rabbits get in—it is not for me to say how they get in, but I have my own ideas. If I do not see a man actually making a hole through the netting I cannot say he made it; but I was told by a land agent in Lord Yarborough's estate office, a land agent who was talking to Lord Yarborough's agent, that he had seen keepers make holes through the netting. I have never seen that done, and although I may have had my suspicions at times, I should not say anything unless I was certain.

974. Is it not a fact that even keepers consider that in this respect rabbits have become more artful during the last few years, and that, as in Australia, where it is credibly reported they have developed certain arrangements for climbing fences—they have not got so far in this country, perhaps—altogether they are very much more able to climb over fences than they used to be?—Yes. Where a 3ft. netting would turn rabbits a few years ago it is not safe to use less than 4ft. to begin with.

975. Is it not the practice of landowners at the present time to increase the height of the wire fencing very considerably? Even in some cases not putting wire netting round the woodlands of less than 5ft. in height?—I have never seen any used 5ft. in height, but I have seen a 4ft. netting; 4ft. is the height, and allowing for the part that goes into the ground, it stands 3ft. 6in. above the ground, and that is the highest I have seen yet.

976. Have you seen any 4ft. from the ground?—No, not 4ft. from the ground; 4ft. is the original size of the netting, 1½in. mesh.

977. You have travelled, I think, in the North of Germany?—I was with the Scotch Society's excursion in 1895.

978. Do you consider that the German methods could to any extent be adopted in this country with advantage?—Yes, but the game question comes in here. I have often thought—it is only my opinion—that one reason why the woods in England are so overthinned is that foresters have been obliged to overthin for game cover, and that applies nearly all over the country. If we consider a real good crop of timber to be such as we saw in Germany, I may say that I have seen equally good timber in England. You can see as good spruce growing in Killarney as any I saw in Germany, and also as good spruce on Lord Feversham's estate which has hardly been thinned at all. They are 70 feet high and very well grown. Foresters have been obliged to thin in many cases to get bottom cover. There is no bottom cover in these thick-grown German forests. As far as the boles of the trees allow you to see, you can look right through the woods. You may say there is no bottom cover. There is plenty of rotten leaves, and so on, but you do not see any briars and bushes such as we have in this country. You cannot grow a heavy crop of timber and underwood together. It is impossible to do it.

Mr. W. B. Havelock.

23 Apr. 1902.

979. Do you think that it is not owing to want of agreement with German methods so much as owing to reasons of preservation of game that thinning has been practised so very much in this country?—That is one reason, but it is also no doubt owing to ignorance on the part of many foresters. Many foresters have not been away from their own particular places, and have not seen how the work is done in other parts.

980. Do you think that under a proper system of forestry instruction in this country forestry could be made very much more profitable than it is at the present moment?—There is not the least doubt of it.

981. Have you observed large areas of land in this country that might be profitably planted and more profitably used than at present?—Yes; in all the three counties I am more particularly acquainted with. I know the North Riding remarkably well, and the north part of Lincolnshire very well, and many parts of Northumberland. There are thousands of acres in these parts which could be planted, and which have never been planted, which would grow timber well.

982. In your statement you account for the fact that owners do not plant on the ground that they have not in many cases sufficient capital to do so. Can you suggest any method by which that difficulty might be overcome?—No, I hardly can. I am not very greatly in favour of the State advancing money for planting. I do not think that many landowners would care to have the supervision necessary. It would be of no use for a landowner to plant trees unless there was very effectual supervision, from the rabbit point of view alone—on that single point.

983. Do you think that the sporting landowner might come into conflict with the State on that question?—I think it is highly probable. Even if the owner who borrowed the money and planted insisted on keeping rabbits down, you do not know what his successor might do.

984. In view of the fact that there are these large areas of uncultivated land which are suitable for afforesting, and that in your opinion a conflict might arise between the landowners and the State, if the State were to advance money to the landowner subject to State supervision, would you be in favour, if the State would consent to it, that the State should undertake to some extent work of that character?—Yes. If the State will do it.

985. You think it might be profitably done as a matter of business on an extensive scale?—Yes, I am thoroughly of that opinion.

986. Another reason which you give why owners do not plant is their lack of interest in forestry. Do you think that forestry instruction would arouse amongst landowners themselves greater interest in this question?—Yes. Particularly if you could educate the younger generation, the sons of the proprietors.

987. Would you not feel inclined to say that the shortness of life and the uncertainty of heirs, the uncertainty as to who a man's heirs may be, and so forth, operate, to a certain extent, as a deterrent to planting?—Yes, undoubtedly it does.

988. But, of course, shortness of life does not apply to the State—the State never dies?—Quite so.

989. (*Professor Schlich.*) I believe the forest estates which you have under your management at present belong to the Earl of Yarborough, and amount to about 6,000 acres?—Between 5,000 and 6,000; scarcely 6,000.

990. Am I correct, but I think I have seen it somewhere stated, that the average income of that is about £1 an acre? I have also seen it stated somewhere that the expenses are about half that?—That is overstated; 5,000 acres would mean £5,000 a year, but the expenses are scarcely half that.

991. I have seen it in some publication, wherever it was. I think it was in the "Land Magazine"?—Lord Yarborough gave me permission some time ago to draw out a statement, if I chose to do it, for as many years back as I cared to go, with regard to the expenses and the receipts, but it takes a good deal of doing.

992. Generally speaking, you would say that the ex-

Mr. W. B. Havelock.

23 Apr. 1902.

penditure at present comes to about half the income or more; shall we put it that way?—It does not come to half; it is considerably below that. I might say that we are planting close up to the felling. There is no land which has been allowed to lie fallow, and we have planted a great deal of new ground into the bargain which the old woods have to pay for.

993. The woods have been more or less regularly managed now for 100 years?—I have a list here for 115 years showing how many trees have been planted every year.

994. It is of much importance to know whether woods in this country which have been managed for a great many years in a good or fairly good manner would actually pay or not. You have given us some information with regard to the rating value of these lands, and you said your forests are rated at something like 10s. an acre?—Yes, that is about it.

995. That same land for agricultural purposes would be worth how much—the rent that is paid per acre? I think you say something about 7s. 6d.?—That is on another estate. The 7s. 6d. an acre referred to another estate in Yorkshire.

996. Give us a general idea. If the land is used for agricultural purposes, what should it be rated at?—Ten shillings would be too much for that.

997. In other words, you mean to say that, it being forest, it is rated higher than it would be, or ought to be, if it were used for agricultural purposes?—It is so. It is difficult to persuade the assessment committees of that.

998. That is another point. My point is that it ought not to be rated at that if it was used for agricultural purposes?—There is one farm on the same estate equipped with modern buildings and everything of that kind, which is not let for 10s. an acre; in fact, for two or three years there was no rent at all. It got into bad condition, and the tenant had it for one or two years for nothing.

999. If I understand correctly, you told Mr. Stafford Howard that the forests were practically rated higher than the land would be if it were used for agriculture. Did I misunderstand you?—I think at the present they are so, because the rental of the arable land in Lincolnshire has come down so tremendously in the last ten years. It has come down one-half in some cases.

1000. What I am driving at is this. Supposing these lands give now a net revenue of 10s. an acre, a great portion of the income is really derived from deferred income, is it not? Because the woods when they were first planted, for a number of years gave no revenue at all?—Quite so.

1001. And, therefore, if you are rated now at 10s., you are overrated?—That is my opinion.

1002. That would not be the average from the formation of a plantation up to the time it is cut over. It is only after you have established a certain stock of timber on the ground that the net income of 10s. begins?—Yes.

1003. What I want to bring out is this: That the rating for existing forests at their present annual net return is, of course, on a wrong principle—that that is not the way to calculate the rating value. Do not you agree with me that the utmost that forests ought to be rated at is the rating value which they would have if they were used for agricultural purposes?—Yes, I do agree with that.

1004. Or, do not you agree with me in this, that the lands ought to be rated from time to time according to the income which they yield; that is to say, for a number of years they ought not to be rated at all, because they are not giving an income?—Yes, that would be better still.

1005. And then they should be rated at a higher rate for the rest of the time while the woods are maturing?—Yes.

1005*. (*Mr. Stafford Howard.*) It would be a very high rate at the end of that time?

(*Dr. Schlich.*) The point which I am making for is this, that you must forego your income for a considerable number of years before you have established any return from your capital?

(*Colonel Bailey.*) You have actually to pay out, and not to receive?

(*Mr. Stafford Howard.*) It would greatly upset the rating authority if you had such varied payments?

(*Witness.*) The simple way is to rate them according to what they are worth as agricultural lands. If you will allow me to say so, if these woods had been planted just with the idea of growing timber as a paying matter, a great deal of the land that is planted would not have been planted. There are hundreds of acres near the Hall, which are valued now at 20s. per acre. No one would think of planting that land with forests pure and simple. I take it that you want to get land at 5s. an acre, or even less than that to begin with. I would not expect such good land to pay for planting.

1006. (*Dr. Schlich.*) My present object was to draw attention to a certain principle on which I suppose further evidence will be taken from some other gentlemen. I maintain that to rate forests according to what they yield at a particular moment is wrong in consideration of the fact that the land does not give any return for a number of years before, and that the utmost you can put on it is what it is worth for agricultural purposes from the start. That is only a casual question which I was going to ask. I believe your estate has been administered more or less regularly for one hundred years. I think I am correct in saying that it is one of those estates in England which might serve as a pattern of management. If you were to go over all the estates in England you would find few estates which could serve better as a pattern of what ought to be done than the forest you are now managing?—I have not seen one so good.

1007. I now want to draw your attention to a very special point. I may be wrong in it, but you can correct me if I am. You are speaking of what you learnt by looking at certain trees. Is there not one portion of the estate which you are managing in which there are certain oak forests on some elevated ground which have not done as well as they might have done; and was there not a great discussion that the wrong kind of oak had been planted there?—I have heard that question discussed by Professor Fisher when he went over the woods with me. He advocated the planting of the sessiliflora for the dry ground there, I think.

1008. Of course there are two varieties of oak, the pedunculated oak, and the sessile oak. This is the pedunculated oak?—Yes, the pedunculated oak is what we have got.

1009. That is on somewhat elevated land?—Yes, on chalky land. It is not adapted for growing oak. It would pay better there to grow ash, beech, or larch.

1010. Do you agree with the view that it would have been better to plant the other kind of oak, if any at all?—I have not had a long enough experience of the two classes of oak. I have both sorts in the nursery, but I have not had sufficient experience of them in the woods.

1011. I think it was fairly agreed that the wrong kind of oak had been planted on the hills?—That was Prof. Fisher's opinion, but personally I have not sufficient experience. My opinion would be worth nothing, because I have not had sufficient experience.

1012. I was further told that there was some proof that the sessile oak had done very well somewhere in the vicinity of an adjoining estate in the locality?—On the Chatsworth estate there is some land very similar to ours, and I noticed it there after Prof. Fisher had mentioned it. I had never heard the point raised until Prof. Fisher mentioned it to me. He pointed it out, and I could then see how much better the sessile oak grows there.

1013. (*Mr. Marshall.*) At a higher elevation?—Yes, and on dry ground.

1014. (*Dr. Schlich.*) What I am driving at is this: that even on the estate which you consider certainly one of the best in England, and which you have administered for a good many years, mistakes have been made in past times?—Certainly.

1015. And in those cases a little more instruction in proper sylvicultural methods and so on in past times would have probably led to better results?—Not exactly in this case. Other reasons operate sometimes. If there is a shortness of money, money must be raised. Perhaps the owner does not care to clear a piece of ground entirely there and then, and he may be advised by someone that there are sufficient young trees underneath them to justify picking the old ones out. I have never seen that succeed yet. I do not say it is not possible, but in my experience it has not answered to

Mr. W. R. Havelock.

23 Apr. 1902.

take out a large portion of the old timber and leave the young trees in. It may do in a sheltered valley, but it will not do in the woods that I have in my own mind.

1016. The point I was getting at was that I understood from information given to me it was fairly admitted that even in these best managed estates of England considerable mistakes had been made in the past in certain localities?—I quite admit that.

1017. In other words, that a little more knowledge of sylviculture and sylvicultural laws would have been conducive to better conditions than are actually present in forests which are otherwise well administered?—Probably. But I would not like to give a decisive answer to that, because other things come in. One reason why oak was planted on this land might be that oak in that day was oak, and was worth a good deal of money. It is also a very useful timber for estate work, and that might have been in the minds of those who planted the land.

1018. It is not a question of oak or not oak, but what particular kind of oak. Experience has shown that in certain localities one oak thrives, and in other localities the other oak thrives best?—I repeat I knew nothing about that until I had had my attention drawn to it two or three years ago.

1019. One more question about these rabbits. You say it was usual to keep rabbits out of plantations, and you have already told us that they generally get through the fence and not over it. Of course, you can make a fence which rabbits cannot get over by bending the top outwards?—Yes.

1020. If you only make it high enough the rabbit cannot jump over it clear; it is almost an impossibility to get over it, and it is safe unless the gamekeeper makes a hole?—Yes.

1021. You have told us that he does so because he meets thereby the view of the owner who wants the rabbits to escape?—I do not say that it meets the view of the owner. I do not think that an owner cares to put up a wire netting and then have the rabbits deliberately let into the enclosure.

1022. There is a confliction of aims and objects, the one putting up the fence and the other making holes in it?—Yes, various personal reasons may enter into it.

1023. In many cases these woodlands have depended in the past upon considerations of game, etc.?—I think that is one reason.

1024. And ignorance of proper thinning is another?—Yes.

1025. Do not you think that taking all these points together it is of the utmost importance to disseminate clear ideas about the value of woodlands and their power of yielding a return, and more particularly to impress that information upon the owners of land?—Yes.

1026. You think if the owners of land had a clear conception of what it means by allowing game to destroy their woods and their plantations, and if they had a clearer conception of what they might expect from their lands if they excluded game, at any rate, from certain parts, it would have a beneficial effect?—Yes, upon many of them.

1027. (*Colonel Bailey.*) I daresay you know it is a recognised principle of sylviculture that in all operations carried on in a crop of trees you aim at producing the best possible final crop upon the ground; that is to say, that one of the chief guiding principles of thinning is to take out the worst trees and allow the best trees to stand to make the final crop of the highest value. Do you think that principle is followed in most of the woods that you are acquainted with?—The forester thinks he is following that principle, but, owing to lack of knowledge, he does not.

1028. Is it not often the case that the condition of the final crop is wholly neglected by taking out the best young trees in order to supply orders from time to time? I am not speaking necessarily of the estate that you are managing yourself, but you must have seen a great many others?—It is done on a great many estates, but I have never been called upon to do it myself.

1029. You have seen it done?—Yes, many times. They pick them out to make the most money at the moment.

1030. Do not you attribute to that false system of sylviculture the failure of a great number of our woods to yield a satisfactory profit?—Yes, of many of the woods.

1031. Is it within your knowledge that private proprietors often leave the woods long after they have ceased to grow profitably, because they have a feeling that people make remarks that they are cutting down their timber? Do you think proprietors dislike to cut down their woods even long after they have ceased to grow profitably?—Yes, that is a fact.

1032. Do not you think that, if the woods on such estates were properly organised under a working plan, so that the amount of fellings to be undertaken each year were laid down on business principles, the very detrimental system of leaving ragged woods standing long after they produced anything, would be modified?—It would to a great extent, because I know that many gentlemen attach more value to the opinion of an independent expert than perhaps they do to their own foresters.

1033. Do not you think the existence of a working plan showing what quantities of wood ought to be cut down every year would do a great deal to remove the prejudice that exists against the felling of timber?—I think it would.

1034. I have often heard it said that proprietors of woods do not wish to undertake the systematic management of their estates, because they fear that this would lead to formality and regularity of the crops, which would destroy their artistic beauty. Do you not think that on most large estates, even supposing that feeling were allowed to prevail there must be considerable areas of land which might be put under regular management?—Yes.

1035. Without in the least degree interfering with the artistic beauty of the parts that are near the houses and along the drives?—Yes, I think so.

1036. You think on most estates areas could be found which could be managed systematically on business principles, without interfering with the amenity of the estates, or with their artistic beauty?—Yes. I might almost say on every estate of any size.

1037. Just so, that is what I think myself. Did you join the excursion of the Arboricultural Society to Germany?—Yes.

1038. How many days were you there?—About a fortnight.

1039. You saw a great deal that interested you that you had not seen before?—Yes.

1040. You think you learnt something even in that short time?—I did.

1041. Do not you think that a State area such as some of us think of proposing would have a most important beneficial effect in showing people what might be done on the soil and in the climate of this country, and would have a great influence on the management of our woods?—Yes, I think that is the best thing that could be done.

1042. (*Sir John Rolleston.*) I would like to ask you one or two questions in regard to your methods of sale. I believe your estate is a very well managed estate in which these things are well looked into. What are your methods of sale of timber, as between the selling by private treaty and by the auctioneer?—We sell, broadly speaking, in three different ways. At the beginning of the felling season, in November, we sell large masses of timber, clearing the ground entirely, selling the trees in lots by tender as they stand. The forester makes a valuation of these lots which is submitted to the owner. The timber is advertised and tender forms printed, and we sell the timber to the timber merchants in £300 or £400 lots. I do not care to put them in larger quantities than that.

1043. You sell upon tender?—Yes.

1044. Do you employ an auctioneer at all?—Not in that sale. We do during the winter in selling the thinnings and some small fellings. We, as a rule, either haul them to the drives by horse power or by traction-engine, and sell them in lots, what we call waggon loads, from 60 to 120 feet each.

1045. Having felled them yourself?—Yes, by piecework, and drawing them out by our own horses or traction-engine. We sell them in from 60 to 120 feet lots, by catalogue, by auction, but the auctioneer only gets a fee for the day. He has nothing to do except to come on that particular day and sell the timber; he has no responsibility for the money.

1046. You have never sold the timber as it stands by auction?—I have never done that, and I would not

Mr. W. B. Havelock.

23 Apr. 1902.

care to start it unless the owner was going to take the whole lot down, because it would be very awkward, if you thought you did not get a sufficient price for it, to take a few here and leave a few there; but selling a big lot standing, if the owner does not think the price comes near enough to the forester's value he can reserve it. We reserved two lots last winter. Of course, I am running a great risk in this case. They were two lots of about £600. Upon my advice Lord Yarborough reserved those lots. We felled them ourselves, and now they are going to be sold by auction in a fortnight or three weeks' time. If when we reckon up the expenses of felling, of hauling, and what we shall get at the sale it puts me in a funny position if we make less than what we had offered us for the timber when standing. However, I am risking that.

1047. You express an opinion about hedgerow timber. Would you kindly tell the Committee what your views are about that?—On many estates a great deal of hedgerow timber might be taken down with great advantage both to the landlord and the tenant. The timber is standing idle, and it becomes nearly valueless. The great objection to taking hedgerow timber down is that it spoils the appearance of the country, but I think that could be overcome if the landlord would make it a condition in negotiating with the tenant that he should take down a certain tree on condition that he might be allowed to plant two or three more in its place. But the tenant must help the landlord to protect the tree from needless damage, because these trees if planted will never do the present tenant of a farm any damage at all.

1048. You think it is a crop that is well worth the attention of landowners?—Not so much as a crop as to beautify the estate, to make the country near the residence more worth living in.

1049. (*Mr. Marshall.*) I have very little to ask you, because you have already given us such good evidence. I would like to ask you a question with regard to this sample of timber that was sold in the North Riding of Yorkshire. I see you put down in your statement 120 ash trees with an average cubic contents of 14 ft., *i.e.*, 1,690 ft., at 1s. a foot. Surely, that is a low price for ash?—They were small ash trees, rather rough. They were not very good ones.

1050. As compared with the ash which you grow at Brocklesby that is a low price?—Yes, we make much more than that price in Brocklesby.

1051. Now as to supply and demand. First of all with regard to labour, do you get plenty of labour for working in the woods? Can you get plenty of men to work under you?—So far we have been able to get plenty of labour.

1052. Do you pay them more than you would an ordinary agricultural labourer?—Yes, they earn more.

1053. Therefore if there is more done in forestry you think there will be no question about the supply of labour? You think that there would always be a supply of labour available for the woods?—Yes.

1054. And that it would also give the labourers a chance of bettering their position?—I do think so.

1055. Now as to the supply of timber and the demand for timber, you say that at Brocklesby you sell it in various ways, and you nearly always have a good demand for it?—Yes.

1056. And even if you had more you would very likely sell it?—Oh, yes, I think so.

1057. That is because you have got an estate which is noted for the good quality of its timber, I suppose?—I suppose it is.

1058. You have a speciality for growing ash, I believe?—Yes, but not only ash—beech and larch also.

1059. Is the demand for timber this year as good as it was last, or have you experienced what has been experienced in the South of England, a fall in the price of oak?—The timber trade is rather slack at the present time, certainly.

1060. Is this timber, which you refer to, oak?—No, chiefly beech.

1061. The fall in price will not affect that at all?—There is little oak in the present sale.

1062. You have an abundant supply of labour, and you do not think there would be any difficulty about that if forestry were taken up, and there would be no difficulty in selling the stuff, anyhow in England?—No.

1063. That applies to oak, ash, elm, and conifer?—One reason, in my opinion, that the timber sells so well at Brocklesby is that it has been a regular thing for many years. We do not cut a lot one year and none the next; we do a regular felling every year, and that is known to wood leaders, who lay themselves out for carrying it to the station. The buyers seldom send their own horses, and the local leaders would not keep horses if there were not a prospect of having wood to carry each winter.

1064. What is the average distance of the woods from the railway station? Give it approximately—I do not mean exactly?—The distances are from two to six miles.

1065. So that you may say that the station is an average of 3½ miles distance?—Yes; that would mean one big load once a day.

1066. (*Dr. Somerville.*) In your experience of steam traction, do you ever haul on the public roads?—Yes. I have not hauled the timber of full length, but jukst for our own use. It is cut into lengths and put into h- traction waggons. The trunks are not hauled by us as they are felled, that is, to the station.

1067. You have not used the public roads with your steam engines?—Yes, we have, but we have had the timber cut into short lengths.

1068. Still you never get far from your own property with your engines?—No, it is all on the property.

1069. You find that the Local Authorities impose no troubles and restrictions?—They have not done so; there has been no occasion. They have tried to extract payments from timber merchants on the ground that their traffic was extraordinary, but have failed.

1070. But is it not a fact that where steam haulage on roads is introduced that the owners of these engines are sometimes rather handicapped by having the bridges scheduled as weak, so that they are prevented going over certain districts?—Yes.

1071. You say you have gained a great advantage by the use of steam for haulage compared with horses?—Yes.

1072. I suppose you never haul to the station for the purchasers?—Never.

1073. But if it is an advantage for you to haul your timber on the estate by steam, surely it would be to the advantage of the purchaser to haul timber to the station by steam?—Yes.

1074. They do not do so possibly because they might be restrained; is that so?—I do not think that is the reason. I do not think many timber merchants have traction engines yet.

1075. But as a matter of business you never tried to sell your timber delivered at the station, using your own steam haulage?—I never have advocated that, chiefly because I have employed about 80 men, and I have as much work to do as I can manage without that. Besides, it is impossible for a single forester to look after several departments efficiently.

1076. You are an examiner for the English Arboricultural Society, I believe?—Yes.

1077. You examine in the principles and practice of forestry, and you have done so ever since examinations were started, I believe?—Yes.

1078. Do you believe there is a demand for education in forestry?—Yes, I do.

1079. And you believe there is a demand for qualifying certificates as obtained through the agency of the examination?—Yes.

1080. You have no doubt made up your mind as to how practical forestry schools for the training of foresters who have aspirations to get into the higher practice of the work should be conducted? Do you think young English foresters can afford to pay fees for the education they can obtain in technical schools of forestry?—Not many foresters could pay fees for their sons.

1081. How do you think the fee difficulty could be got over?—I should like to see an experimental area of forest ground laid out where the young man could go for a year or two years in addition to his ordinary run of work. He might go for a year or two years to an area of that sort where he might perhaps only receive a small wage, but which would be sufficient to keep him while he was learning.

1082. You mean putting in work at the same time?—Yes, getting as much pay as would keep him in necessaries, and at the same time learning what would enable him to become a forester.

1083. For about two years he would be satisfied if he could get a sufficient wage to maintain him?—I think so.

1084. That is to say, if he were getting his education at the same time?—Yes, I think so, decidedly.

1085. You think that this Forestry School should be in connection with an area of forest land?—Certainly I do.

1086. You took part in the excursion to Germany, I believe?—Yes.

1087. And I suppose the excursion, among other things, enabled you at once to understand what was meant by the writers on forestry when they discussed details of management. Previously you had some difficulty in realising that, but when you saw the thing before your eyes you understood what it meant?—Yes.

1088. Do not you think that it must be difficult for an English forester to go to Germany to see what you have seen? Is it possible for them to see in their own country what you had to go abroad and see?—Of course in the course of time it could be made possible.

1089. You think an area of land which was managed in such a way as to illustrate certain principles and systems would have a distinct educational value?—That is the very thing, I think.

1090. Not only would this area suffice as a training ground for men who would work while they were having their education, but you think land agents and landowners might occasionally visit such an area and see it themselves?—Yes, I know personally many land agents who would.

1091. You think the Arboricultural Society would visit these areas, and that their members would receive due object-lessons which would be of use to them in their works?—Yes.

1092. You speak of the very high quality of the ash in Lincolnshire. Would you put the ash along with the larch as a tree which began to give a profitable return at an early age?—No, sir. I think the larch would pay a larger sum earlier than the ash would do. But in some of the woods larch was formerly mixed with ash. The larch was taken out many years ago, and there is a heavy crop of first rate timber left. That was when there was a boom in larch for railway work.

1093. Do you say that ash thinnings at the age of 30 years were easily marketable?—Yes, easily marketable. We could make 1s. a foot for such ash. Small ash sells better than anything—even better than small larch.

1094. In your experience has it ever been possible to use netting as a precaution against rabbits twice over?—I have done so this winter.

1095. You have had it, I suppose, 10 or 12 years, and then moved it to a separate wood?—Yes. It has been in use 8 or 10 years, and then it was turned upside down; that is the best way. But it has had a strand wire running along the top, which has been a great protection. It has not been broken down, as it was tied to the strand at every 3ft. or so.

1096. You do not believe in forests being debited with the whole expense of fencing, I suppose?—No, I do not think there is any reason in that.

1097. Perhaps you think half is the proper proportion?—Yes.

1098. Do not you think there is a tendency on the part of landowners to load their woods with expenses, so as to keep down the rateability?—I have not had experience of that, and I do not think so. What I have seen has been a matter of book-keeping.

1099. There is a tendency to load woodlands with debts which do not belong to them?—Yes, it is easier.

1100. You have cited excessive fencing?—Yes, and hunting and shooting tracks.

1101. I suppose in many cases the accountant forgets to credit the woods with the shooting rent?—It has never been so credited in my experience.

1102. I suppose you regard your woods as worth a 1s. or 2s. an acre for shooting?—Yes.

1103. But the accountant forgets to credit that; it may be that 20 per cent. of the total annual income is from this source?—In some cases they do not even put that on the timber.

Mr. W. B. Havelock.

23 Apr. 1902.

1104. If there is a shoot on the landowners take away the inferior workmen and use them for beaters, do they, and you get credit for that?—Yes, we get credit where we can.

1105. You say that you are under the impression that woods are often rather highly rated. Had any case occurred to you where you think woods should be cleared of rates altogether?—Yes. I think that when planting a large area it would tend to encourage planting if these lands were free from rating for a few years.

1106. I suppose woods are often planted for shelter, and not from the point of view of timber at all?—Yes, that is so.

1107. Have you any experience of planting woods for shelter belts?—Yes, but not exclusively. Around farmhouses I have planted several such belts.

1108. And you think the creation of shelter belts improves the land?—Yes.

1109. So you would not think I was exaggerating if I suggested that the creation of 5 acres of shelter belt would raise the value of 20 acres of land 1s. per acre per annum?—That would not be overstating it.

1110. If shelter belts are created to raise the agricultural value of the land in the neighbourhood, the improved value as far as rating is concerned comes into force as regards improvement of the rates?—I do not follow you.

1111. If you improve the agricultural value of the land by the creation of shelter belts, of course the rating authority lays an increased assessment on the land on account of its being improved agriculturally, and that improvement has been effected by the woods. Would it be fair, do you think, to secure an increase of the rates from the improvement of agricultural value, and at the same time to rate the 5 acres of woodland which have been created for shelter purposes also?—It would be very unfair.

1112. Does it not look as if the shelter belt should not be rated because the rates fall upon the improved agricultural value?—Yes, I should think so, but I had not thought of that point before.

1113. There is one other point which has not been mentioned so far. The coppice is not so valuable as it used to be?—No.

1114. There is a tendency to convert coppice into high forest?—Yes.

1115. Have you ever known any profitable result from the creation of such forests from coppices?—I know some in process of being done, but I do not think the matter is sufficiently advanced to enable me to say whether it would be profitable.

1116. You think it would be necessary to clear off the coppice and plant straight off?—I think it would be better to clear all the coppice off. That would pay better in the long run.

1117. (*Chairman.*) You think a regular supply of home timber would strengthen the home market, facilitate the transport, and help to get better prices for timber?—Yes.

1118. And, so far, you think the regular laying out of woodlands on forest plans would promote that end?—Yes.

1119. Have you had any experience in natural regeneration in Lincolnshire or Yorkshire?—I have had one this winter in Lincolnshire. It happened in this way, and although accidentally done, yet the result was similar to what I saw being obtained by artificial means in the beech woods of North Germany. On a twelve-acre plot the timber was sold standing in November, 1900, and during the ensuing winter the purchaser felled and dragged out all the trees, leaving only the beech, which then stood thinly on the ground. Now in 1900 there was an extraordinary crop of beech mast in North Lincolnshire, and the stirring of the soil caused by the horses dragging out the other timber covered most of the mast. The beech trees were gradually felled during the summer and autumn of 1901, so the young beech plants had the advantage of their shade during the hottest part of the year. Seedlings came up in thousands, and if the ground had been my own I should have wired round the plot, and trusted for a crop to the natural-grown seedlings. However, I did not risk that, and so during the winter of 1901-2 I had the ground planted with trees 4ft. apart, not, of course, using many hardwoods. I have

Mr. W. B. Havelock.

23 Apr. 1902.

never before seen such a fine crop of naturally-grown seedlings in England.

1120. There is no difficulty in keeping down the ground game?—Yes there is, if you go in for the extensive preservation of pheasants.

1121. There has never been any system of natural regeneration on the properties that you have been connection with, has there?—No, not natural regeneration. But in some of these woods at Brocklesby, according to Lord Yarborough's private book, I see that certain areas which are now giving good crops were sown with seeds to begin with. Acorns were sown in many places. Of course, I cannot say whether they were filled up with trees afterwards. But the seed was sown to begin with.

1122. Do you think that the return that you spoke of with Lord Yarborough's sanction would be of any use to this inquiry if there were time to prepare it?—I think it would, sir, and I think if the Committee were to approach his Lordship directly there would be no difficulty in getting it. In fact, he said as much to me, but I would rather it came from the Committee.

1123. I will only question you with regard to the employment of foresters. Are there any openings for good men to superintend, each of them looking after several small estates?—Do you mean for one man to superintend several estates?

1124. Yes?—My father did a good deal of that in Northumberland and Durham, but I do not know of any other case.

1125. There should be no difficulty in the way, I suppose. If the owners of small estates were interested in forestry, why should not several small estates be managed by one man. That, I take it, would provide another opening for trained foresters?—Yes.

1126. Do you think the present standard of foresters' salaries is sufficiently high to attract good men into the profession?—Except on a few big estates, I do not think it is. A forester has to know so much, indeed has to know a little about everything on the estate, that the salary is not sufficient to attract him.

1127. Is there anything else of which you have knowledge which would interest us, and which you wish to mention?—No, sir.

1128. (*Dr. Schlich.*) You said you had sown acorns on one or two occasions?—Yes.

1129. In what way?—In lines, but only on a small area.

1130. What is the result?—They are doing splendidly, better than those we planted.

1131. You expect to get better trees from the acorns than from those which you planted?—I think so; they appear to be straighter. They are now about 16 years of age.

1132. I mention that because I have often advanced the view that most of the old oaks in this country were not planted, but were the result of sowing?—I follow.

1133. Do you find any trouble about the seeds from game?—I do. I have tried every precaution. I have put them in paraffin oil and red lead, and then they have been taken by the mice and pheasants.

1134. (*Colonel Bailey.*) You say that this was only a small area which was sown with acorns?—Yes, only a few long rows.

1135. How far were the rows apart?—Eight feet.

1136. And how close together did the oaks come up?—I sowed them very thick in trenches one foot wide.

1137. They came up very thick in the rows?—Yes.

1138. Were rabbits getting in?—No, there was wire netting around the area.

1139. Have you seen any difference in the frequency of attack from rabbits on planted trees as compared with those sown?—Yes, the rabbits are more keen on the planted plants.

1140. When the plants are put out several feet apart you think that the rabbits go for them more than they would if there were masses of them on the ground?—Yes; and if I may say so, I heard an old woodman say—and I attach a very great deal of importance to what is said and observed by born woodmen, woodmen who have been born and trained amongst the woods—that he thought rabbits were what he called more "woodkeen" than they used to be.

Mr. A. C. Forbes.

Mr. A C, **Forbes**, called; and Examined.

1141. (*Chairman.*) You are Forester at Longleat?—Yes

1142. And you have had some experience of technical training in forestry?—Yes, I have had a little.

1143. You obtained some training in Germany?—Yes, and also under Dr. Somerville in Edinburgh.

1144. I believe you were at Eberswalde?—Yes, I was there four months.

1145. Did you derive much benefit from your technical training?—Personally I derived a great deal of benefit.

1146. Do you find many others keen to get this training?—No, I do not think so, because under present conditions it is just a risk whether they get any benefit from it.

1147. You mean there are not enough good appointments?—No, the appointments are there, but it does not follow that the best men get them.

1148. Can you suggest any method by which it would be made easier for landowners to select good men either by diplomas or in any other way?—The best plan would be to get young men working on good estates recommended by their employers. I do not think that diplomas have much influence in determining the selection of a man at present.

1149. On the whole, do you think that amongst foresters there is a keen desire for better opportunities for training in this country?—Yes, amongst foresters themselves I think there is, those who take an interest in their work. Those who simply work for the sake of what they can get out of it do not care very much about it.

1150. You think there is a lack of interest amongst owners and agents as regards having the opportunity of selecting from a number of good foresters?—I think a man is selected on his practical knowledge or experience more than on his technical knowledge.

1151. Do you attach more importance, in connection with the training that you have had, to the object lessons that you saw at Eberswalde, or to the theoretical training that you obtained?—I attach more importance to the object lessons, decidedly. Of course, I was handicapped in the matter of the language; I did not understand the language sufficiently well to take full advantage of the lectures. I did not go there with the express purpose of taking the lectures, but rather to see what was going on.

1152. Do you think that what is most required here is an area for demonstration?—Yes, we have plenty of areas, but the difficulty is——

1153. I mean a State area for demonstrating, showing how trees can be best grown, and how their products can be best utilised?—That is a very difficult question. because there are so very few woodlands on an estate which are managed as a separate portion of the estate. The woodland department is very likely mixed up with the general department.

1154. But if you had a State forest or a model forest where training was given in growing timber, thinning timber, pruning, felling, putting it on the market, and manufacturing it, and giving training to men for all the different branches of forestry or manufacturing, that would cover all the ground?—Not all the requirements, I think.

1155. What would be left out?—The working of a residential estate; you would require experience in that, because that forms a great deal of the forester's duty nowadays.

1156. Gardener's work?—No, not exactly gardener's work, but in a model forest you would not get many branches of work that you have to do on a residential estate.

1157. You would get all that practical work?—Yes.

1158. I do not suppose you would want to stay there more than a couple of years, or a year, in your training, or perhaps even less?—On the residential estate?

1159. No. If you were taking your training in a State school or in a State forest area it would be like a short engagement; you would not spend the greater part of your life there?—No, not more than two years.

1160. You would have abundant opportunity in the other places where you obtained employment to collect that part of your knowledge dealing with an ornamental garden?—Yes.

1161. I see that you have dealt in your statement (*Appendix VIII.*) at some length with the question of an advance of loans to land owners by the Government, and you think that security can be given in the form of middle aged or nearly matured woodland, the loan to be expended on planting or other approved forestry work. At present timber is not a mortgageable form of property, is it?—No, I think not

1162. Therefore you may have an estate with £5,000 a year of agricultural land which can be mortgaged up to the hilt, but you might have an equal value in timber on the same estate which you could not mortgage at all. I suppose you would make it mortgageable like the agricultural land?—I should not burden the estate; you must not burden the estate.

1163. You would burden the timber?—Yes.

1164. To do that you would have to put it under a regular plan; you would have to insure it against fire, and so on?—With a mature crop there would be very little risk of fire.

1165. Yes, if it was all of one age, but you would only insure the mature crop?—Yes, or the nearly mature crop.

1166. You would have to make some provision against gales by means of shelter belts?—In the case of gales the timber would not be blown away; you would have the value of it.

1167. Not necessarily; you would not have the value of it. Do not you get something less than the value of it after a gale?—Yes, if you have a large quantity, but not as a general rule.

1168. You would not be able to mortgage very small lots of wood?—We should not mortgage it to the full value.

1169. At any rate it would have to be under a regular plan?—Yes.

1170. And be felled at the proper time?—Not necessarily. If the mortgagee liked to pay off the loan by other means he could do so.

1171. You must take it that your loan exists. I am talking of the formation of a loan. You could not have a loan without putting your forest plan in as a schedule to the deed of the loan; it would be the only form of security you would have?—Yes.

1172. You might have to take some security in the case of hard woods, in mature woods, against ground game?—The mature crop would not be damaged by the ground game.

1173. But the partly matured would?—Yes, the three-parts matured is the youngest I should take for the purpose.

1174. You do not think that needs any protection against ground game?—No, none whatever.

1175. You have never seen trees of any size damaged by ground game?—I have seen beech damaged to some extent, but not enough to affect its value within 20 years.

1176. Are you aware that many land owners attach considerable importance to the borrowing capacity of the estates or property?—Yes, but what I think you must do in this case would be to separate the woods from the general estate.

1177. I understand that, but once the land owners found they could borrow money on the security of their growing woods you think it might lead them to attach more importance to that form of property?—It would do away with a good deal of the personal loss.

1178. And it might offer an effective stimulus to the average land owner to place his woods under a regular forest plan?—Yes, I think it might encourage him, at any rate.

1179. And you think, therefore, that perhaps clearing the way to systematising timber mortgages as you suggest might prove to be an effective means of bringing about the methodical management of woodlands?—Yes. I think it might after a number of years; of course it would not come about at once.

Mr. A. C. Forbes.

23 Apr. 1902.

1180. You think that a short course of sylviculture and the practical demonstration in woods of the working of forests and woodlands in definite centres is an important matter?—Yes.

1181. Do you attach more importance to giving instruction at convenient centres; or, taking one or more centres (a more limited number), to give a higher quality of instruction?—The high quality of instruction must be left to the man's own initiative, I think. Of course it would be so in any case, but as long as the facilities existed the man could take advantage of them if he chose.

1182. You would have a high course of instruction for a few, and local demonstration for the many?—Yes.

1183. You think that literature is wanted; you suggest a special forestry supplement to the Board of Agriculture Journal. Have you got any good text-book in forestry?—Yes, there are several; Professor Schlich's is the standard on the subject.

1184. I meant for the ordinary working foresters?—No, there is none at all; they would not read them if they had any.

1185. They do not read much?—No, because many of them do not know what forestry means in fact.

1186. (*Dr. Somerville.*) Do you find there is much demand for education amongst foresters in this country?—Amongst themselves I believe there is. I think the man who takes up forestry does so for the love of the thing.

1187. You find, do you, that when once a man has gone a certain length into the study of forestry that it becomes fascinating to him?—Yes, certainly.

1188. And, in fact, although the rate of remuneration is not very high, possibly there is an attraction in the profession beyond what can be gauged by a mere money return?—In my own case there is, although I cannot say it is so for everyone; but I think the majority of us feel that.

1189. Do you think that a highly trained forester would have a fairly free hand to manage the woods that are put under his charge?—Not under present conditions, I think.

1190. Do you think as a general rule the forester has to take his orders from somebody else?—Yes.

1191. I suppose that somebody else is the agent?—Yes, probably the agent.

1192. Or the landlord?—Yes.

1193. I suppose it is quite reasonable that if the landlord takes an interest in his woods, and especially if he also has knowledge of the woods, that he should take over the general supervision of the woods on his estates?—He should do so.

1194. And you would not, in point of fact, as a forester yourself, object to being generally advised by either the landowner or the agent, if these men spoke from knowledge?—No, not at all.

1195. But I suppose you find in many cases neither the one nor the other has any sound idea of the principles of good sylviculture?—Very few of them.

1196. Do you think that the condition of things in this country would be improved if facilities for educating these two classes were provided?—I think a great many who take an interest in them would be benefited by such means, but of course those who take no interest whatever would not.

1197. You have handed in a fairly exhaustive statement of your suggestion as regards State loans for forest purposes: is this evolved from your own experience, or from your own consciousness; or is it based upon any system that is at present in vogue in any country in Europe?—It is not in vogue as far as I know.

1198. It is what you would call a set of original suggestions?—Yes.

1199. Are you acquainted with the conditions that at present prevail with regard to the State lending money for forestry purposes?—Only under the Land Improvement Acts, that is all.

1200. You know how the money is obtained in that case?—Yes.

1201. You know, I suppose, that the money is paid over on the certificate of an inspector?—Yes, for the work done.

1202. When the work is done the money is paid?—Yes.

Mr. A. C. Forbes.

23 Apr. 1902.

1203. And it does not matter a fraction what takes place to the woods afterwards, that is to say, there is no control exercised over the wood that is created with that money?—No.

1204. Would you consider that an estate was at all benefited by an expenditure of £500 upon young plantations if the young trees were largely destroyed by rabbits within the next year or two after the creation of those woods?—No, none whatever.

1205. Do not you think that under the present system the estate is not protected or the heirs of the estate are not protected as regards the expenditure that may be laid out from the Government sources?—No, I think it often amounts to a burden on the estate.

1206. You, in other words, would be inclined to recommend that inspection should go on concurrently with State loans?—Yes.

1207. Do you think that landowners would take advantage of the credit of the State in connection with the extension of forestry?—I think they would in many cases.

1208. I see that you would make growing timber the security for the repayment of the loan?—Yes.

1209. And you would have the loan repaid within a reasonable time?—Yes, within 30 years.

1210. You would not, in fact, burden the rest of the estate with the loan, but you would burden the timber crop on the estate?—Yes, the timber crop; I would not touch the rest of the estate in any way.

1211. (*Mr. Marshall.*) I see under heading 3 of your statement you refer to the formation of Government forests in rural districts containing less than 5 per cent. of woodland, acquired by purchase or borrowed from the landowner, rent free by an arrangement with the owners. Why with less than 5 per cent. of woodland? There might be 95 per cent. of land absolutely suitable for plantations in one part of the country, but in other parts you might have land of such high agricultural value that it would be useless to plant on it. Why do you specify that you would only form Government forests with that proviso?—I have explained that afterwards. I do not refer to big manufacturing districts of high value; I am talking of a purely agricultural district.

1212. You would advocate the formation of Government forests in districts where there is not already 5 per cent. of the acreage under woodland, and where the agricultural value of the land was not too high?—Yes, that is so.

1213. Land is supposed to be acquired by purchase or borrowed from the landowner, but you could not form a Government forest on land borrowed from the landowner. How do you explain that?—I give him the option, if he wants the land back again, of buying the property back at its cost value. I explain that later on.

1214. (*Colonel Bailey.*) I see in the statement which you have laid before the Committee you have named a large number of faults that you found with the present system of management. For example, you say that the absence of a definite rotation causes great financial loss. The different age classes are rarely represented in proper proportion; there is a variation in the amount of the growing stock of timber from year to year, caused both by the felling and the deterioration of matured timber; that early thinnings made to encourage herbage and surface growths for game tend to produce timber of poor quality and diminished height growth; a large proportion of the crop is often harvested before it is matured or it is allowed to stand after reaching maturity; there is an excessive proportion of branch and brushwood to saleable timber, and consequently a diminished yield of timber, and so forth. You also say that there is a general lack of organisation in all branches of wood management. These are the principal faults that you find with the existing wood management?—Yes.

1215. Do you think those faults are widely spread in the country?—They are almost universal.

1216. Do you think the fact that those faults are almost universal is widely recognised, or is its recognition confined to yourself and a few others?—It is recognised amongst foresters, but I do not think it is recognised by many landowners.

1217. You think it is generally recognised amongst foresters?—Yes.

1218. Do you think that the foresters who generally recognise this are desirous of putting themselves in a position to improve matters?—Yes, I think they are.

1219. But you said just now that if a text book were put into their hands they would not read it?—I was not talking then of foresters. I was talking about the men whom I am suggesting should benefit by these short courses of lectures, the woodmen, not the managing foresters.

1220. It is the woodmen who would not read?—Yes, not the managing foresters.

1221. You think there is a widespread desire amongst managing foresters to improve their technical education, so as to enable them to avoid the faults that you have detailed?—Yes, I think so.

1222. How do you think that could best be done: how do you think this training could best be arranged for?—The first stages of the education I think should take place in the woods.

1223. In what woods?—In the estate woods, the best that could be found in the district.

1224. Private estates?—Yes.

1225. Do you think that the woods of a private estate could be managed continuously so as to produce the best results?—They might.

1226. In view of changes of ownership, changes of foresters, and changes of agents, do you think that the woods of any private estate are certain to be brought to maturity in the best possible form and under the best possible conditions?—There is no certainty about it

1227. Does that seem to point to the necessity for a State area for instructional purposes?—Yes, it points to the necessity, but you must recollect that we have groups and woodlands in all our estates which are almost perfect specimens of sylviculture.

1228. You may have the groups, but they have arisen in a rather haphazard fashion. You cannot rely upon producing these groups, I suppose, with that regularity and in that condition in which you want to show them for educational purposes. Does not it seem necessary, therefore, that there should be a State area on which work can be done systematically, and results suitable for instruction ensured?—It would be a very great advantage.

1229. I see that in one part of your memorandum you suggest the formation of Government forests in districts with a small proportion of woodland. Had you any idea of education in that?—No, I had no idea of education in connection with that; it was simply a question of economics. It might take the form of an educational forest, a model forest for the district with regard to species and management.

1230. Do not you think that if you were establishing State forests for educational purposes, they would be more necessary in well-wooded districts than in districts bare of woods?—Yes, for educational purposes alone.

1231. I see you mention that another fault in the present management is the hesitation shown by proprietors in the clearing and replanting the old woodland. What do you mean by that?—They would rather keep 20 trees to the acre than clear the ground right off and replant it.

1232. What is the reason of that feeling?—It is a sentimental reason in many cases. Another reason is that so long as a few trees stand to the acre they are available as game cover, and many owners value woods as game cover only; they do not take the trouble to replant them.

1233. Is it not the fact that in a large number of the woods which are kept more or less for profit, or for profit alone, the crop is allowed to stand long after the time that it ought to be taken away, so that in the condition in which you now find it, the wood is growing little or nothing per acre per year?—That is so in many cases.

1234. Do you think that is due to a general ignorance of the value of well-stocked woods—want of realisation of the value that the woods might have if they were properly managed?—No, I do not think so. I think it is due more to the fact that the owner for the time being thinks that he loses and nobody else in particular gains by taking down an old crop and replanting a new one. The chance of profit from a new crop replacing an old one is so remote that he hesitates very long before taking what to him seems a heroic step.

1235. (*Dr. Schlich.*) I see you advocate the appointment of a Standing Committee of Forestry by the Board of Agriculture with a staff of consulting experts, and you enumerate a number of the things that this Standing Committee is to deal with. Amongst others you have mentioned the collection of data and statistics relating to British forestry, the home timber trade, the organisation of experiments and investigations in practical forestry?—Yes.

1236. We have already heard something about the first part of these, but I should like particularly to refer to the experiments and investigations in practical sylviculture. You have already told us that you think these experiments and investigations in practical forestry might be organised in conjunction with estate foresters?—Yes.

1237. And the results published from time to time?—Yes.

1238. What sorts of experiments and investigations do you refer to?—The growth of trees on different soils and in different places as forest trees, and not as ornamental trees.

1239. You would make investigations with regard to the selection of species for a particular locality?—Yes.

1240. And then watch the progress of the development of the wood?—Yes.

1241. You would ascertain the amount of timber that it would produce at certain stages?—Yes.

1242. And you would also make experiments with regard to the proper degree of thinning, having a particular object in view?—Yes.

1243. In other words, do I understand you to suggest that a collection of data should be made by degrees, which are to be put together as on the Continent, and incorporated into yield tables?—Yes, that would be one branch of the subject.

1244. In fact, tables which indicate the development of woods in different localities, and the development of different species, etc.?—Yes.

1245. Do you consider a collection of such information of first-rate importance?—Yes, I do.

1246. In other words, you think we should be all the better in devising the system of management of the woods of this country if we had such tables referring to this country?—Yes, certainly.

1247. And that it would simplify in many respects the management, and enable the forester, or whoever is the manager, to decide with much less doubt what is the best method of treatment to apply?—Yes.

1248. In connection with State forests, I believe you have been to Germany, and probably also to France, and seen the State forests there?—Yes.

1249. You have seen enough to know that the experiments extend over a considerable period of time?—Yes.

1250. You know they cannot be done in a year, or 5 years, or many of the experiments in 10 or 15 years; that you must continue them in order to get data which are worth having?—Yes.

1251. Do not you think if you do that in estate forests that you run a considerable amount of risk? After having bestowed a great deal of trouble, labour, and money on the question, may it not all of a sudden come to an end and be knocked on the head by the proprietor changing his mind, or by his dying and by his being succeeded by a son who takes no interest in the subject, and starts cutting down the timber because he wants the money? Do you think it is a safe and wise thing to adopt such a plan in ordinary estate forests?—I think so, to a limited extent, in short rotations.

1252. What do you call a short rotation?—In 30 years.

1253. Of what?—Pit wood, larch, and similar species.

1254. Do not you think there are a great many other methods of treatment on which it is much more important to get reliable data than on that of pit wood, which is exceedingly simple? For example, if you grow trees which are worked under a rotation of 80, or 100, or 160 years, like oak? Do not you think it would be much more sensible to take the bull by the horns, and say we must have State forests for that?—Yes, much more sensible, but if you cannot get State forests you must put up with the other.

1255. I do not know that you cannot get State forests: we have a great deal of State forest at present in this country—between 60,000 and 100,000 acres. After all, the war in South Africa is not going to last for ever, and we might buy some additional areas when they are required?—That is the only way.

1256. You see the point I am coming to is that you propose to do this in connection with estate forests. I say it is a very risky operation to do that in connection with private forests?—Yes, it is risky.

1257. You admit that?—Yes.

1258. And it would be better to do it at once in forests owned by the State or by large Corporations?—Yes, certainly.

1260. That it is a very desirable thing that these experiments should be started as soon as possible in estates in which it is assured that they will remain under rational management for a considerable period?—Yes.

1261. That is the point I wanted to bring out. You have also seen enough on the Continent to know that these forests would be eminently adapted for the instruction of students where the experiments were going on?—Yes.

1262. Have you been in Chorin or Freienwalde, near Eberswalde?—Yes, I have been in both those places.

1263. You are aware that those two things are always combined there? You make your experiments, and at the same time they are the most valuable objects of instruction to the students?—Yes.

1264. You have seen enough to know that they can be carried on alongside of each other?—Yes.

1265. You thus kill two birds with one stone?—Yes.

1266. (*Professor Campbell.*) You have had considerable technical as well as practical training in forestry, I believe.—Yes.

1267. How long did you spend in learning technical forestry?—I was learning it twelve months.

1268. Had you a training in practical forestry before that?—Yes.

1269. How long?—I was two years working in the woods, but before then I had a good deal of training in general estate work.

1270. Then you proceeded to a school of forestry, I believe?—Yes, I then went to Edinburgh.

1271. What subjects did you study there?—Forestry, botany, chemistry. I took the agricultural course as well.

1272. Was the whole agricultural course necessary for your training as a forester?—No, I took it so as to make the most of the time there.

1273. You ought to be in a very good position to say what would be a good course for training a forester in technical matters. If you had your time to go over again what subjects would you take up?—My first step would be the practical training. I think he should have that training until he was 18 or 20 years of age, and until his mind was fixed on the subject. Then I think he should take one or two years of technical training, including courses of botany, chemistry, and so on, and sylviculture, which you might term technical. Then he could go into the woods again as foreman or improver.

1274. And if you had the advantage of a State forest where forestry could be learned, would you advise going there before entering for the course, or after?—Before.

1275. Do you consider all these subjects which you have mentioned necessary for a forester?—No, not absolutely necessary; but I think botany and chemistry are necessary.

1276. You yourself have derived a great deal of good from having studied these subjects?—Yes.

1277. And you would be in favour of giving a course of chemistry and botany to all?—Certainly those two subjects, and field engineering, and such things as that.

1278. Would you confine that to estate managers?—No; I do not think it should be confined to estate managers, because much of it comes into a forester's duties.

1279. I see that in your memorandum you recommend a staff of sub-inspectors to inspect land on which planting by the Government is contemplated or suggested. And I read somewhere else in your memorandum that you advised the same thing in respect to landowners who are contemplating planting?—Yes.

Mr. A. C. Forbes.

23 Apr. 1902.

1280. Do you think landowners would take advantage of that?—Many of them would, those who take an interest in the matter.

1281. Do you think foresters as a rule would be willing to call in the services of an expert?—Yes, many of them would, I think.

1282. And that would be a very great advantage?—Yes.

1283. Would not that do away with much of the waste which is going on at the present time owing to wrong methods of planting?—Yes, in connection with planting wrong species.

1284. And in respect of different methods of planting as well?—Yes.

1285. Do you think the forester would continue to carry out the instructions of the expert if he visited two or three times a year?—Yes, if he saw the advice was justified.

1286. Do you know of any cases where the expert has been called in and great advantage has accrued to the forest in consequence?—I believe that on the Duke of Bedford's estate Professor Schlich has been called in; but as a general rule it is not customary to call in anybody. The local man in charge is supposed to know everything.

1287. The forester?—Yes.

1288. Your experience is that he does not know?—He does not in all cases.

1289. (*Mr. Stafford Howard.*) In your opinion the condition of the forests in this country is very bad, and the management of woods is not what it might be, and there is room for great improvement?—Yes.

1290. You agree, I suppose, that one of the most important things is to interest landowners in the matter, and to get them to bring about some improvement in their own estates?—Yes.

1291. The suggestion which you have made about this Standing Committee, which is to get together facts and information and publish it, is with the view of enlightening people, and showing them what might be done to some extent?—Yes.

1292. Do you think it would be possible to show landowners that financially they can make a better thing out of their woods than now?—You could show them, but I do not know whether they would act upon it.

1293. You could show them by experience of certain well-managed woods how the same thing could be done elsewhere, and without sacrificing sporting?—You must put up with the sporting in all British forestry operations; you must regard that as a necessary evil.

1294. Could they improve the financial result of their woods without limiting or sacrificing their sport?—Yes.

1295. Do you include rabbits in that statement?—No: I exclude rabbits.

1296. You think we must exclude rabbits?—Yes, but even with rabbits I think it is possible to improve the condition of English woods by a system of clear felling.

1297. Could you improve them so as to make it pay?—Yes, you could; but you would have less profit if you kept rabbits.

1298. And you think that a State forest for the purpose of making experiments and demonstrating and instructing would be very useful?—Yes.

1299. And if there were such a forest for the purposes of making experiments and demonstrating, so that a certain number of practical working woodmen could go, and young men could be apprenticed there, it would be a very good way for them to begin, you think?—Yes.

1300. If there were a school on the spot they could take advantage of some of the lectures?—Yes.

1301. If there had been such an establishment as that, would you have gone to it yourself?—Yes, certainly.

1302. Meanwhile you think there might be an advantage if landowners would combine in having local lectures, and taking advantage of cases where good woods are to be found, for the purposes of demonstration?—Yes, there is a very great loss owing to the lack of knowledge on the part of the woodman.

1303. If those things were organised, do you think that many would take advantage of them?—I do not think the older generation would, but I think the young men who aspire to something better would.

1304. Do you know of any instance where something of that kind has been done?—No.

1305. I think Colonel Bailey told us of some case in Scotland where he had been asked to lecture?

(*Colonel Bailey.*) Yes, that was by arrangement with the landowners. One of the landowners was the Chairman of the County Council of Aberdeenshire, and I think it was really through his instrumentality that that course of lectures was asked for.

1306. (*Mr. Stafford Howard.*) If in your neighbourhood there were a course of lectures, and men had leave to go, do you think you would be able to demonstrate what you lectured upon?—Yes; we have 10,000 acres of wood, on adjoining estates.

1307. Do you think there is plenty there to show all it was needed to show?—For that district it would be sufficient material. For instance, on the Chiltern Hills beech woods are managed on a different system.

1308. So you could not show everything?—No, but we could show specimens of everything in that district.

1309. Therefore you think if landowners formed forestry associations, as they have formed agricultural associations, they might themselves start experimental stations?—Yes.

1310. But there would be a risk, as Dr. Schlich has pointed out, owing to the landed proprietor changing his mind and not wishing to have it any more. But still, I take it it would be a good thing if they did that?—Yes.

1311. (*Colonel Bailey.*) I suppose that in order to carry out such experiments you would require an expert?—The experiments should be arranged according to the facilities for carrying them out. They are not bound to be of any special form. In the district I am living in now we have a large area of oak woods which are growing on land which is not adapted for oak at all. It is a cold clay land, and oak will not grow on it. I think coniferous trees would do better on that land than oak.

1312. (*Chairman.*) When were they planted?—100 years ago, I think; at any rate, not much less.

1313. And they are doing no good?—None whatever. There is land in parts of the New Forest in the same condition.

1314. (*Dr. Schlich.*) Are you a head forester?—I am a head forester.

1315. I know you are one of the most successful head foresters in this country, and I take it that you are decidedly of opinion that young men who want to qualify themselves for positions of forester or head forester should begin with practical work on the estate?—Yes.

1316. And that there should be superadded thereto instruction afterwards?—Yes.

1317. If they can have it?—Yes.

1318. But you attribute great importance to their beginning practical work under an estate forester?—Yes.

1319. Supposing you had been told that the work should be done in a garden instead of on an estate, would that be the same thing?—No, it would not be quite the same thing.

1320. Why?—Because a man must begin under the conditions in which he is going to live, I think.

1321. You would not consider it equivalent at all for the man to work in a botanical garden, even if there were a small arboretum added to it?—Not at the commencement of the training.

1322. You want him to go into an actual forest estate?—Yes.

1323. And, of course, there is one thing more required; do you not think it is of the highest importance that he should go to an estate which is managed by a thoroughly competent manager or head forester?—He would be all the better for it, but at that stage of his training I do not think the management of the woods would be very much affected.

1324. It is important that the men who want to save time and get on rapidly should work under a thoroughly competent estate forester?—If they want to save time they might, but a boy beginning at 15 would not be able, for two or three years, to discriminate between good management and bad.

1325. He would be simply a labourer who would be working in a mechanical way?—Yes.

1326. I should have thought you would have agreed that it was of great importance that the man should do practical work before he goes to a school where he can learn forestry, and that he should work under a thoroughly competent forester?—He would be all the better for it, but it may not be available in his district.

1327. I want you to tell me whether you think it of importance that he should work under a thoroughly competent forester?—Yes, certainly it is of importance.

1328. And that the more competent foresters we have to instruct them the better?—Yes.

1329. (*Chairman.*) I gather from your interesting statement that forestry pays well at Longleat?—It pays very well.

1330. You give one example of larch putting on 100 feet an acre a year up to 30 years of age?—Yes.

1331. And I suppose it would go on after that?—Not at that rate.

1332. Yes, but it would be of considerable value even later?—Yes, in our district larch at 40 years gives the best return.

1333. And even at 30 years of age a good deal of the larch timber which you felled would bring in 1s. a foot?—Yes, more than 1s. a foot in some cases.

1334. And that would work out at a very large annual rental on the land?—The net rental would be 30s. to £2 an acre on a 50-year rotation. I have not given a rotation of 50 years in my statement. I do not think you get an average yield of more than 80 feet per acre on a 50-year rotation under favourable conditions.

1335. Your Douglas fir gives an extraordinary return up to 20 years of age?—We have no crops older than that at that particular place.

1336. You think that counties might do something for demonstration in this subject?—Yes, I think so, technical instruction.

1337. Did you see Dr. Somerville's sections in Northumberland, at the County Council farm there?—No, I have not seen them.

1338. One could not anticipate County Councils raising very much by way of rates for forestry purposes?—I think where rates were chiefly drawn from large landowners it might be done.

1339. But landowners themselves show very much indifference on the subject of forestry?—Yes.

1340. And in a country where the education rate is rather low there would probably not be very generous grants for forestry?—No, sir.

1341. You have no objection, as I gathered from what was brought out by Dr. Schlich, to State forests, but you look upon them as the best system?—Yes, certainly.

1342. And you suggest a method of progress supposing a State forest cannot be established?—Yes.

1343. But you believe in State afforestation if you can get the land?—Yes, but I think you might find a difficulty where the desired area is split up among different landowners.

1344. You want to have land in large blocks?—Yes.

1345. And they would have to be better tended than those we have at present?—Yes.

1346. Mr. Lascelles, in the information he gave us in 1887, spoke of the New Forest as being an area of 40,000 acres, which was waste. Do you know the New Forest?—Yes, I am living not very far from it now.

1347. Do you agree with Mr. Lascelles' view?—Yes. I think he might have gone further and said that 60,000 acres—the whole of it—was practically waste until very recently.

1348. And none of the State forests which we have in this country are of the slightest value for educational purposes?—I believe their value rather lies in showing what should not be done than what should be done, from what I have seen of them.

1349. Supposing you had a good system of State forests, with a regularly organised service of foresters would not that tend very much to raise the status of foresters as a profession in this country?—It would raise a man socially, but I do not know about his position. Of course it might improve that in course of time.

1350. But if he were raised socially he would be better paid, would he not?—It does not follow.

1351. Do you consider there is sufficient remuneration for foresters to attract the best men into the profession?—No, I do not think so. It would not remunerate a man for going to any expenditure on his training.

1352. Can you give examples of extraordinary claims for road traffic which have been successful?—Do you mean any timber merchants I know who have kept traction engines? Yes, they are always having claims made against them.

1353. Do you believe it is a necessary part of the equipment for removal of timber from forests?—Yes, especially in the case of large timber.

1354. Have you any experience of how timber land is affected by tithe, or by local rates, or by Death Duties?—Death Duties are one of the greatest drags on forestry in this country.

1355-6. That is, they are raised on the capital value of 25 years purchase of the unimproved pastoral value?—Yes, and not only that, but I believe they are fatal to all organisation in woods, because for eight or ten years after the death of an owner everything but the very necessary work is suspended on many estates.

1357. But is not the rate on woods lighter than it is on agricultural land, if it is restricted to 25 years purchase of the unimproved pastoral value?—I am speaking now of the working expenses of woods. Those expenses on a death occurring are reduced in order to make up for the heavy death duties, and that very often disorganises the whole working.

1358. So, if a good forest demonstration area is established it should be where the best results can be shown?—The best forestry results, yes.

1359. You advocate the creation of forests where there is sufficient woodland to encourage it?—Yes.

1360. But to have a thoroughly good demonstration area for training purposes, as well as for showing what can be grown, you would choose the best site that can be found for growing timber?—Yes, and which presented the most varied nature of soil.

1361. (*Mr. Stafford Howard.*) You said, in answer to the Chairman, that the greater part of the New Forest was waste?—I think it is bringing in very little return, considering the large extent of ground.

1362. Do you mean that the land is too bad?—No, I do not think it is; I do not think there is anything to bring in the returns from. I am, of course, speaking of the results of administration 100 years or more ago.

1363. Are you not aware that some of the old woods which were planted in the 18th century have been pronounced some of the best that have been seen of pure oak?—Yes; but there is a large area of oak there.

1364. Yes; but part of the trees had to be cut down and others planted?—Yes.

1365. What is your experience of the New Forest?—I have been there half-a-dozen times or so; but I am not well acquainted with it. I know the country generally very well.

1366. (*Chairman.*) Do you think there is much land which would pay to put under timber cultivation?—Yes; in certain districts there is a good deal.

1367. Poor agricultural land as well as waste lands?—Yes, on the sands and gravel especially, but not on the clays.

1368. There is a good deal in the West of England?—There are the greensand and tertiary formations in Hampshire, Dorsetshire, and Somersetshire.

1369. Have you experience of any other part of the country?—I know Bucks very well, and part of Berks.

1370. (*Dr. Somerville.*) Do you know of any improved management of woods in your own recollection?—I think there is improvement in the direction of thinning and selection of species.

1371. Do you think that foresters are beginning to realise that education can do something to improve the returns?—Foresters do realise it, certainly.

1372. When you began to study forestry 12 or 14 years ago it would not have occurred to foresters to treat larch materially differently to other timber in the way now adopted?—No.

1373. They would have expected the same number of trees from one set of circumstances as from another?—Yes.

Mr. A. C. Forbes.

23 Apr. 1902.

1374. That is the outcome of your observation and experience?—Yes.

1375. And, therefore, management which would produce a good result in one case would produce a disastrous result in the other?—Yes.

1376-7. And yet ten years ago that was not recognised?—It was not, generally.

1378. Do you think that larch planting in this country has had a materially deteriorating effect upon sylviculture?—Yes, in districts where planting has been done within the last 100 years.

1379. Do you think the foresters' argument that what has been good for a larch wood has been good for the rest, and that it has been managed far too openly, is the cause of that?—There is no doubt a good deal in that. Of course one of the effects of over-thinning is due to game as much as anything.

1380. But still larch has had some influence?—Yes, I think so.

THIRD DAY.

Thursday, 24th April, 1902.

PRESENT:

Mr. MUNRO-FERGUSON, M.P. (*Chairman*).

Sir JOHN F. L. ROLLESTON, M.P.	Professor JOHN R. CAMPBELL, B.SC.
Mr. EDWARD STAFFORD HOWARD, C.B.	Mr. JOHN HERBERT LEWIS, M.P.
Professor W. SCHLICH, C.I.E., F.R.S.	Mr. GEORGE MARSHALL.
Colonel FREDERICK BAILEY, R.E.	Dr. WILLIAM SOMERVILLE.

Mr. REGINALD H. HOOKER, *Secretary*.

LORD GLANUSK (of Crickhowell, Wales), called; and **Examined.**

Lord Glanusk.

24 Apr. 1902.

1381. (*Chairman.*) I believe you can give us some information?—I do not quite know what you wish information upon.

1382. We should be very glad to have your evidence on one or two points to which you have alluded in a short summary which the Secretary gave me; for instance, with regard to afforestation in Wales?—All my knowledge has been gained in Breconshire, and Breconshire is divided into three classes of soil; the upper part of the county is Silurian, the central is old red sandstone, and the extreme south is the coal formation. The old red sandstone is by far the best for growing timber, and for every other purpose. Larch planting is a great source of profit amongst the owners of the land, and under favourable conditions it is extremely profitable, but I must limit that to where the conditions are favourable. If it is not too high above the sea, and if you plant a reasonable sized plantation, not less than four acres, it is a profitable transaction. If you have to fence a single acre it costs precisely double in proportion to the fencing of a plantation of four acres. You will see that at once, because in the four acre plantation you omit the inside fence. I do not know whether you follow me in that?

1383. I think we fully understand that matter?—Quite so. Supposing there is no clearing to be done, which would cost 10s. an acre, and supposing there are no rabbits, which are very costly to exclude, even if you can exclude them, I find that a plantation of four acres costs about £39 to fence. Then, of course, the cost of planting depends entirely upon whether you grow your own trees. I give about 3s. 6d. a thousand for my trees, and grow them in a nursery, and when I plant them out at four years old they would cost at the nurseryman's £2 5s. 6d. a thousand, but if you grow them yourself you can grow them at £1 or under, which, of course, makes a vast difference in the profit when you have to wait 45 years for your returns. If you can plant at that, and if you get £46 worth of thinnings in ten years' time, when they are fit for hedge stakes, wattlings of a river, and so on—I make in my four acre plantation £46 after ten years, and after 20 years I get another thinning, which is then what we call pitwood, to support the roof of coal-pits, and I get from these particular plantations £67 10s. worth, and I sold the whole four acres at the end of 45 years for £400. I have calculated that out. If you take 3 per cent. for your money the plantation gives you your 3 per cent. and your capital back again, and you get an annual rent of about 18s. an acre for your plantation. That is a good plantation. If you want 4 per cent. for your money you must have less rent. If you want 5 per cent. you must be content with a still less rental. If you take 4 per cent. you will have 13s. an acre, but if you take 5 per cent. for your money, as I calculate it, your would have 9s. for your acre. If your plantation requires clearing on account of being very rough land, you would have to pay 10s. an acre at the very beginning for that, which would reduce the rent by 1s. 8d. an acre. If you have to try and exclude rabbits that will cost you another 9s. an acre of your rental, and would knock your profit down to very little indeed, to about half the rent at 3 per cent. That is on a plantation 670 feet above the sea, and at that height, and on fairly good land, a larch plantation would be a very valuable thing up to the point I have mentioned. If you take a plantation very much higher above the sea it is different. I did hear at one time that the Government had a kind of idea of afforesting some of the Welsh hills, and as an example I will tell you the results of large plantations upon the mountains. My late grandfather, 50 years ago, planted two considerable pieces of the mountain; one was 24½ acres and the other 32 acres, so that they amounted to something over 56 acres together. The initial expenses of the one cost him £177 and the initial expenses of the other £217—I can give the items if they are desired—which comes to a total of £400 for the lot. We waited 45 years for our profit, and we sold the whole thing for £475. If you take 3 per cent. interest on the original sum and £113 for the up-keep, which is a correctly ascertained figure, it cost altogether £1,600, and as we got £475 for the two plantations it landed us in a loss of £1,130, which on fifty acres of land cannot be called profitable. Then it must be remembered that with regard to the profit I have taken on the lower lying plantations, when you have taken a crop of larch off land you do not leave the land in the same condition that you found it; it is full of larch stumps, and quite unfit for cultivation in any other way except by the re-planting of larch trees. My experience does not extend to a second crop of larch trees, but I do not think they will be anything like so profitable as the first. Unless they were very near a station and could be planted without fencing, and so on, I do not think that the scheme for planting the Welsh hills would land the Government in anything but a very large loss.

1384. Up to what height do you think you could plant profitably in Wales?—If you desire to have it I could give you plantations of different heights. I have some which I hope will be profitable up to 1,800 feet. But the plantation I took, which was a fair plantation, was 670 feet above the sea. I think you might say that you could plant hills a little higher than that, perhaps up

Lord Glanusk.

24 Apr. 1902.

to as high as 1,000 feet. The other two plantations that I gave you run from 1,400 or 1,650 feet above the sea, and I am sure those are likely to be unprofitable.

1385. You would take the margin of a healthy range for the cultivation of profitable plantations as about 1,000 feet?—I think that is quite the outside of it. I have also tried planting the very top of a mountain called the Epynt, in Brecon, where I have one or two isolated houses. I tried to plant there for shelter without any idea of profit, and I have tried every sort of tree I can think of, but they will not grow. Nothing will grow there.

1386. Of course it would be quite easy for us to ascertain from a map, but you probably would not know what proportion of Wales lies above the thousand foot line?—I am afraid I must refer you to the Ordnance map. About one quarter of Breconshire is open mountain, and we do not leave mountain open where we can cultivate it. As I say, in Breconshire a quarter of the whole county is open mountain, which would hardly grow large trees, and in North Wales the proportion would be still greater.

1387. Have you any experience of the value of other kinds of timber grown in Wales besides larch?—I am afraid not. I cannot give you the value of the timber we do grow, but any woodman would be able to give it to you. We have poplars and oak, and the Spanish chestnut grows very well, although it is not, of course, indigenous. We have also elm, but elm is too brittle for our very windy country.

1388. On this very bare hill would plantations of 2,000 or 3,000 acres, if it were possible to form them, flourish better than the 50 acre plantation which you have experimented on?—What I have said with regard to fencing applies very much to that, as you multiply by four and divide your fencing by two.

1389. With large areas there is more shelter, and that perhaps might enable you to plant rather higher with advantage?—No. I do not think the lower trees would shelter the higher ones.

1390. Is planting well done in Wales, as a rule?—Yes, I think so. We think we plant all right. Our method of planting is this: we have three men and a boy, and the three men are each armed with what is called a Scotch planting tool, a heavy iron thing, to make a hole, and the boy's business is to bring the trees, which are about four years old and about three feet high, and put one in each of these holes. The men work the soil in again with this heavy tool, tread the soil in, and the larches seem to grow extremely well.

1391. Is it easy to get good foresters, head foresters managing men, in your part of the country?—I have two foresters, one a Welshman and the other a Scotchman. The Welshman was bred up to the business by his father, who was also a forester. He was what we should call a better class of labourer. These men can measure the timber and plant, and can estimate the cost of planting, and so on.

1392. Do many landowners and agents have much technical knowledge of planting?—I should say the landowners do not. They have nothing like what you call a technical knowledge. I have not myself, but all these bills are brought to me and I know how many trees they want. We plant 4 feet 6 inches apart.

1393. What about the land agents?—Our general custom is that the forester measures the trees and then he brings the measurement to the land agent. A forester has not the same knowledge of prices of the day that the land agent has. You must understand that the price of timber varies very much. Pitwood, for example, when I was a young man was certainly double what it is now, owing to the importation of foreign woods.

1394. The management of woodlands is a good deal divided between the owners, the agents, and the foresters; there is no one in particular who is directly responsible, is there?—No. Of course the forester is responsible. He knows what trees he requires. I work my own through my own nursery. I do not buy trees, except as seedlings, from the nurserymen. I do not think, if you buy trees at four years old, which is necessary to have good trees, and pay £2 5s. per thousand for them, that it will pay at all. In making this calculation I have charged £1 a thousand.

1395. Do you think that wood managers and estate managers have sufficient knowledge of marketing timber to the best advantage?—Of course we market timber by selling to the dealers. We sometimes sell by auction, sometimes by tender, and sometimes we sell by offering them to dealers with whom we have dealt before. We always have the trees valued before we put them on the market, and if we do not get something like the value we put upon them ourselves we withdraw them, unless we are very much in want of money at the moment, which is not often the case. If you sell them by auction you have the difficulty of having a ring against you; the dealers frequently make a ring. If you sell by tender it is troublesome to the dealers, and sometimes they will not tender, and you can then only deal by offering them to one particular dealer. They pay in bills, and we generally give them a discount for cash, and take the cash at once.

1396. Do you think that a State model forest, worked in connection with university training or a forest school, would add to the productiveness of the woodlands by increasing the technical knowledge of the different classes interested in it?—I think that with our simple foresters, with the skilled agent, and with a landowner who has a sort of knowledge that every landowner is sure to get as he goes on, we can do it. I not see where you can improve very much upon that.

1397. Upon the present system of training?—I do not think so. If you take a book like Brown's "Forester," you will see he expects foresters to know all sorts of things, even foreign languages. But I do not think it is an advantage in the trade for a man to know a foreign language unless he is going abroad, when, of course, he must know the language of the country he goes to.

1398. I mean instruction in this country, of course. At present, as you are probably aware, the means for any technical training are very limited?—Yes.

1399. Supposing that forestry was properly provided for in a course of instruction at Oxford or Cambridge, do you think that many young landowners going there, or sons of landowners, would take more interest in it?—That I cannot say. I think if young landowners did have a knowledge of the sale of timber, mensuration, planting, and all that, it would be a good thing for them. But they could get that if they chose to go into any first class agent's office.

1400. You are satisfied that the training which they get at present is sufficient for the foresters or the nurserymen or the saw millers who may have to work on the estates?—I think so.

1401. Forty-five years is about your paying rotation in Wales, is it not?—Yes. You must remember that, in addition to the 45 years, you cannot replant again in the same year. You have to wait again at least two years to let the land see the sun before you plant again.

1402. Is game a serious hindrance?—We have no hares. Squirrels are our greatest enemies, because they can get right to the tops of the trees, and just take the bark off, and then the wind knocks the tops off. You will see hundreds of the trees with the tops knocked off. You cannot protect yourself against the rabbit. If you put a wire fence round the plantation it is very costly. In the particular plantation that I speak of, it cost me £9 1s. 6d. for the wire, or about £2 an acre, and that knocks the profit to pieces altogether.

1403. Do you think that any measures might be taken to reduce the nuisance of squirrels and rabbits?—I do not know. When you begin to interfere with Nature you do not quite know where you are going to land yourself. Sometimes I let the farmer have a day at the squirrels, and they kill a lot of them.

1404. Do you find that the tithe or local taxation is much bar to making the woods pay?—I should say not. Taking plantations all round, I think the local taxation is put rather high in our neighbourhood. It is put at 5s., 6s., and 7s. an acre, which, I think, is rather high, but I should not say it was a bar.

1405. (*Dr. Somerville.*) I suppose that in Wales you have a tithe on the land, as in England?—Yes. The landlord pays it now, and includes it in his rent.

1406. Does a tithe in some cases run to as much as 2s. and 3s. an acre on woodlands?—No.

1407. Is it much less than that?—Yes.

1408. I may tell you that in England there are plenty of cases where the tithe runs to 2s. 6d. an acre, or sometimes even more?—We have nothing of that kind, I think. Where you plant the open part of the mountains there would be no tithe. Also in planting the mountains you must remember that when you talk of the large forests, such as the Chairman was speaking about, the tenants have sheep-walk rights through the

Lord Glanusk.

24 Apr. 1902.

mountains, and you would have considerable difficulty in getting rid of them.

1409. I suppose that the custom which prevails in many places is for a tenant to have some land lower down, with a right of running sheep on to the mountain?—That is our general custom.

1410. A system of commonage?—Yes; he can run as many sheep on the mountains in the summer as he can keep on his farm in the winter; that is the general rule.

1411. I suppose you depend mostly on larch for profits where planting is concerned?—Yes.

1412. Are you troubled with larch disease much in Wales?—I have not had any experience of it myself, but my neighbours have.

1413. Do you think it is on the increase of late years?—We did not know of it until the last few years.

1414. But you have not yourself experienced much of it?—No, I have not had much loss by it.

1415. A tree that is coming very much into favour in this country from the profitable point of view is the Douglas fir. Have you tried that at all in Wales?—I have not tried it for profit, but it grows grandly with us. It is the quickest growing tree we have.

1416. I suppose the reason perhaps why you have not tried it for profit is that you cannot obtain the plants at a reasonable rate?—That was a reason. If we could get them at the same price as larch we should do very well.

1417. You say you would leave the land bare or fallow for some time after you take the crops of larch off?—For a couple of years.

1418. I suppose that is partly in order that the stumps may decay to such an extent as not to encourage beetles?—We think it is desirable to let the land see the sun, which it has not seen for a great many years.

1419. Still, it is not the custom which prevails under systems of scientific sylviculture. On the Continent and in many parts of the world the forests have occupied the same land for hundreds of years, and there has been no clearing, and consequently the ground has been shaded all that time, and, apparently, without any injurious effects?—Would that go to replanting, do you think?

1420. I should think so, and we have it on evidence also that it is not desirable in many cases to allow the land to lie bare at all. Weeds spring up and interfere with the next crop to some extent, and, of course, there is the loss of any return upon the land during the time?—Yes.

1421. However, possibly local circumstances determine cases. As far as I gather from your figures the cost of planting at those high elevations is considerably more than it is lower down—is not it?—I gave you the figures at £40 for four acres, £10 an acre for the lower plantation. Of course, I gave you £400 for 50 years, and that was rather lower; one is £10 an acre and the other is rather lower, as you see. I should tell you also that the higher plantation in this case was partly stone wall. It is so long ago that I cannot give you the reason, but perhaps wire was more expensive than it is now.

1422. I think it will strike many people that £10 an acre for planting even such a comparatively small area as four acres was very high. We have it, I think, on evidence that the cost of planting, apart from the cost of fencing, in many cases does not come to £2 an acre?—I gave you the fencing and planting. I should not give you the same figure for planting alone.

1423. If you plant 4½ feet apart you require about 3,000 trees for the acre, and if you charge them at £1 a 1,000, that comes to £3 an acre for the cost of the material?—I plant 2,551 trees to the acre, 4ft. 6in. apart, which we find to be the most profitable way. I have planted in all sorts of ways, but I find that the most profitable. If you charge them at £1, that is something about £2 10s. an acre. Then, of course, you have to haul those trees, and plant them when you get them up, and so on.

1424. How many trees do you reckon that these three men, assisted by the boy, will put in in a day?—We consider that planting an acre takes two days with three men and a boy.

1425. That is to say 1,200 trees for a day's work?—Yes.

1426. Or about 400 trees per man?—Yes.

1427. It has been stated, not before this Committee, but in the transactions of one of the Arboricultural Societies, that injurious forest insects are imported into South Wales in large numbers through the agency of the timber which is brought from France. Have you ever heard of a complaint of that sort?—I have had no experience of that.

1428. (*Mr. Marshall.*) You were kind enough to tell us that you gave the land two years rest. Do you then generally plant it again?—Yes.

1429. With larch?—Yes, with larch.

1430. Do you plant larch clear without the mixture of any other trees?—We think it better. I have planted with other trees, but I do not think it answers.

1431. You do not plant any shelter belts round them at all?—We do sometimes plant spruce firs round the edge, but I do not think there is much in it.

1432. Have not you had an instance on your estate—I think I remember hearing about it—of one plantation being cut twice during your ownership?—Yes; I have one instance of it.

1433. And that did remarkably well?—Yes. It was twice in my lifetime, not in my ownership. It occurred when I was a boy. It was a profitable plantation on about the same level as the one I have given of 600 feet above the sea.

1434. Evidently in a place that suited the growth very well?—Yes.

1435. With regard to larch disease, you say you have not had it, but your neighbours have; can you give us a reason why you have been immune from it? Is there any difference in the land?—The larch plantations I have are mostly on the old red sandstone. I naturally speak with hesitation, but I think the disease has been chiefly on the Silurian, or on the Cambrian formation, which is a kind of shale, very poor stuff. Also the soil in the north of the country is very shallow; what we should call unscientifically, rock. You get to the hard rock directly.

1436. With regard to labour, have you any difficulty with labour down there—you are in a coal mining district?—Labour is dear. An ordinary labourer would get 18s. a week.

1437. That is the man who works in your wood?—Yes.

1438. Would he get a little more than the ordinary agricultural labourer?—No.

1439. About the same?—About the same.

1440. If woodlands were more gone in for, it would not very much better the position of the man who works in the wood in your district? It would not give him more work, or give him a rather higher wage?—No. When I went down there they were getting 12s. a week, but now they get 18s., which makes a difference.

1441. What is your opinion of the rent of the land? What would you suppose that this land of 670 feet altitude—64 acres—would be in rental value?—It would be about 15s. to 18s. an acre; I do not plant this land.

1442. And the land at the higher altitude—the 60 acres?—No rental at all.

1443. Just a nominal rental for the sporting rights?—No, it was part of the mountain, a sheep walk. It was planted by my grandfather on the mountain as a general exhibition of ownership, I think, more than anything else. When I came to work it out for the purpose of giving you information to-day the loss was so large that I should not think of planting it any more.

1444. Are those particular plantations beyond the Hermitage, high up?—One was beyond the Hermitage, and the other over the hill in the Cwmdu Valley. I have cut them down, and I have not replanted them.

1445. (*Colonel Bailey.*) You said, I think, that there were immense quantities of pitwood imported from abroad?—I think that is so.

1446. Into your part of Wales?—Yes.

1447. I suppose there is much more imported wood used than is locally grown?—I think so.

1448. Do you think there is a vast market?—I have no real knowledge of that. I live in a mining country,

Lord Glanusk.

24 Apr. 1902.

but I have had nothing to do with mines for a great number of years now.

1449. But you believe as a resident in that part of the country that there is a great market for pitwood timber?—I do; the price has gone down very much.

1450. I suppose that is so all over the country?—We sell it by the cord.

1451. Do you grow wood specially for pitwood?—No. It is the thinnings of the larch plantations.

1452. At what age are they generally sold?—Twenty years. On the particular plantation I was alluding to the sale of pitwood at the age of twenty years would come to £57 10s.

1453. Do you know whether the miners themselves who buy this wood prefer it to foreign timber, or how does it compare with foreign timber in their minds?—I cannot tell you that. When I had anything to do with the coal industry we used my pitwood for propping up the roofs of the mines.

1454. You mentioned that you did not think it would pay to plant largely over the Welsh mountains, because you think they would only bear one crop, and that a second crop could not be raised which would give as much profit as the first?—In planting on the Welsh mountains you would plant on land which I assume would cost you nothing, or next to nothing.

1455. And you think the second crop would be worse than the first?—Yes.

1456. Is that the result of your experience, or why do you think so?—It is what my agent gives me as being the result of his experience, but, as I said, I have no experience of it myself.

1457. You are speaking of larch woods?—Larch entirely.

1458. Grown pure—without a mixture of other species?—Yes.

1459. I ask this question because it is new to me to hear that. Of course it is known in woods of pure larch, if they are left to grow beyond a certain age, owing to the thin character that the wood assumes, there is a certain deterioration of the soil; but in parts of the Continent of Europe where larch is grown as an important crop, that difficulty is met by mixing larch with beech or silver fir, or some tree of that nature. Has that been tried in Wales?—Yes. I have woods planted with forest trees amongst the larch.

1460. Do you find that successful?—No, I do not think it is, and we have left off doing it. We do not think it is successful.

1461. Have you grown woods in that way up to a considerable age, or are they quite young still?—The intention in all those woods was to plant ornamental woods, and to take what larch we could, to use the larch as nurses, but I do not think the wood taken as a wood would be so profitable as planting larches.

1462. As regards the individual larches, do they grow better or worse when mixed in that way?—I think it is the larch that hurts the other trees.

1463. The larch gets on pretty well under those conditions?—The larch gets on pretty well generally.

1464. You said that on certain high exposed ground, where you had a certain number of isolated houses, you had failed to raise trees?—Yes.

1465. What species of trees were they?—We tried larch, Scotch fir, and sycamore.

1466. Was there any special difficulty that they had to contend against besides mere altitude?—Peaty soil.

1467. And strong winds?—Yes.

1468. Were any special precautions taken to protect those young trees? I suppose they died when they were young?—They grew up little stunted trees like those you see on mountain tops. We could not grow them to any size.

1469. They were just planted in the ordinary way?—Yes.

1470. Without any special precautions?—Yes.

1471. I have seen at the top of a very high mountain in France, exposed in the way you speak of, beech trees grown successfully by building little rough mounds on the windward side to shelter them. I suppose you did not try any plan of that sort?—No.

1472. They were just left to themselves?—My own opinion is that that would not have made much difference, because they were turned off about six feet from the ground.

1473. Do you think other trees grown under the shelter of these would have succeeded?—No.

1474. Very often in exposed places on the Downs, and elsewhere, you see a piece of the outside of wood that looks as if it were shaved off, and then gradually further and further away from the wind the trees grow up all right?—I see that by the seaside in England, but it will not apply to the top of the Welsh mountains.

1475. You said, I think, that you did not believe any special technical training was necessary for forestry, that all that was necessary could be learned in the agent's office. Would you hold the same principle as regards agriculture?—I rather think I would. I think that the tenant farmer's son has a better chance than a gentleman trained at a college such as Cirencester and those places.

1476. And you think agricultural colleges are not necessary?—I would not say that. If I had a son going in for agriculture pure and simple I should certainly send him to one of these colleges. They learn all sorts of things there, veterinary knowledge, etc., which may be useful.

1477. If a man's profession was to be that of managing forests of great value, and the value of large forests is enormous in good situations, would he not be likely to require a similar sort of training to manage them efficiently?—My own feeling is that the man trained from youth under a forester would have the knowledge he requires without the expensive apparatus that you seem to have in your mind.

1478. But that would not apply to a man following the profession of a farmer, for instance. He could not learn his profession adequately from a farmer?—If a gentleman is going to start a farm I think all the knowledge he acquires of soils and things of that kind is very interesting to him, and may do him good in farming.

1479. I will trouble you with one more question, which is perhaps hardly relevant to the enquiry we are making, but which will interest me. You mention putting in plants with a heavy tool that drove the hole into the ground. What age were the plants?—About four years.

1480. Were they raised in your own nursery?—Yes.

1481. In what condition were the roots, straight or curled?—The roots were very good. I had intended to bring one up to-day to show you.

1482. Were they straight roots or curled round?—They were roots that looked as if they had gone into the soil in every direction.

1483. They were in a natural position?—I believe so. Those trees came from my own nursery; they are bought as seedlings, and they are left until they are yearlings, and they are transplanted in the nursery to give them a little more room.

1484. In some of the English and Scotch nurseries they do that. It is the custom to plant them out in shallow trenches, and the roots get a bend to one side. Yours have not that defect?—No; all my trees are as well as they can be.

1485. (*Professor Schlich.*) I think you said, in reply to Mr. Marshall, that land which gave this high return used as larch plantation on the lower elevation was worth for agricultural purposes from 15s. to 18s., or about the same that it gave by being put under larch?—I think it would be.

1486. I did not quite catch what you said about the value of the inferior plantation upon the hill?—That was open mountain.

1487. What would that be worth an acre if not used for forestry?—It is used only for sheep walks and sporting purposes.

1488. What would it bring as such?—It is never let. It increases the value of the farm adjoining. Some of these farms have perhaps 400 or 500 acres of sheep walk, even though it is a small farm. You get your profit in the farm below.

1489. It is thrown in with the farm?—It is thrown in with the farm. It is common land. The soil belongs to the lord of the manor, subject to the grazing rights of the tenants.

Lord Glanusk.

24 Apr. 1902.

1490. May I ask what is about the total area of your woodlands?—I do not know exactly: perhaps about 600 or 700 acres, or more I dare say.

1491. Do you grow principally larch there?—Where we have planted for profit it is entirely larch. We have old woods besides.

1492. Ornamental woods?—Ornamental woods.

1493. What you have grown for profit, however, is all larch?—Yes.

1494. And you have no experience with regard to the economic growing of trees of any other species for profit?—No.

1495. Your only experience in this respect is restricted to larch woods which you cut over at the age of 45 years?—Yes, with two thinnings before.

1496. Am I correct in stating that your opinion that an improved education is not wanted is based simply on the growing of larch woods which you cut over at the age of 45 years?—When you say my opinion is that education is not wanted, you must limit that, if you please, to the growing of larch trees. I think the present education of the forester is sufficient for that.

1497. That is what I mean. Your opinion with regard to further improvement in education of the forester not being called for is based on the experience which you have gathered in growing larch woods, which you cut over the age of 45 years?—Yes.

1498. You have no other experience with regard to that?—No. When I spoke about the thinnings being £46 in ten years and £57 10s. at twenty years I was referring to the four-acre plantations, not to a single acre. All the thinnings I have been giving as a good plantation run over four acres.

1499. What aspect had the good plantation of four acres on the lower elevation?—The aspect is slightly north-east.

1500. What was the aspect of the upper plantation which was not a success?—There are two or three plantations, all high; they were on the two sides of a mountain. The aspect of one was south-east, and the aspect of the other would be almost north-west.

1501. The accounts for the two have been kept separate, have they not?—I am afraid we have not kept them. You must understand that on an estate they are planting one time of the year, and doing all sorts of things, such as hauling, at other times.

1502. I only want the mere fact recorded that they were not thrown together?—No.

1503. But they were very much exposed to wind, especially those on the north-west?—Yes.

1504. How far are these woods from the sea?—Between 30 and 40 miles.

1505. But they are very much exposed?—They are very much exposed. Another element in their being so very unprofitable is that they are high up in the mountain, and are very hard to get down, and they are also about ten miles from the nearest canal.

1506. And there are no roads to transport the timber?—Not from the mountain. You have to get them to the valley first.

1507. And probably the cost of transport is very high?—Yes.

1508. If that material, instead of being situated on the hill, without roads, had been situated in a place like your four-acre plantation, it would probably have fetched a much higher price, would it not?—Yes. If I had planted 50 acres of good agricultural land, of course I should have got a higher price. I should have got a still higher price than the price I gave you with regard to the low-lying plantation, because the fencing would be so much smaller. I might have bought a piece of land where the fences were already around it, which would have made a great difference. But I do not think it would answer. We generally feel it does not pay to plant land that is worth more than 5s. or 6s. an acre. An experienced agent cautioned me not to plant any land over 8s. an acre.

1509. (*Mr. J. H. Lewis.*) You have drawn attention to the great difference between the prices that prevailed 30, 40, and 50 years ago and those which prevail now?—Yes.

1510. Do you not think it possible that, owing to the timber supplies of America and Scandinavia becoming exhausted, the prices in this country may considerably increase, I do not mean, of course, in the next few years, but at some long interval?—That is so speculative a question that I am not able to answer it.

1511. I suppose there is some possibility of a rise of that kind taking place?—But it seems to me so remote that I do not take it into consideration in planting. The difference in price, I might say, is quite half what it used to be. We used to get about 28s. a cord in the woods, and now we get 14s. or 15s., or something of that kind.

1512. That is, of course, owing to the rise in steam merchant shipping and the greater facilities for transport that exist at the present time?—Yes.

1513. When you spoke of a plantation of four acres, did I understand you to say that it cost £39 to fence it?—Yes.

1514. Do not you think that is rather a high charge for fencing a four-acre plantation?—Well, take the labour. I have 40 perches of fencing.

1515. What kind of fencing?—Wire and oak posts. 7 yards with us is a perch, and I charge it at 3s. a perch if you are planting with oak, and 2s. 6d. if you are planting with larch. That comes to £12. Then you have six wires of No. 5 at £11 a ton.; 240 yards require 14 cwt. at 11s. a cwt., and that is £7 14s. You have a man and a horse hauling the wire to the wood, 7s. You have 1,680 galvanised iron staples, 16s.; you have two horses two days carting stakes, £1 8s.; you have 548 cleft oak poles at 6d., which is £13 14s.; you have 12 straining posts at 5s., £3. The whole of that comes to £38 19s., and if you have to clear the ground you must add £2 for 4 acres, or 10s. an acre.

1516. A large area, of course, would cost proportionately less?—Yes. If you double the size you halve the cost precisely. I might just show you a little diagram which will explain that directly. All the inside of the fences go out when you enclose a larger area.

1517. I think we can quite understand that it would reduce the cost very considerably. You might possibly show a very much better result upon a larger plantation than you would on a plantation of four acres if you were to take into account the reduction in the cost of fencing the larger plantation?—That is so.

1518. You consider the result you have attained of being able to sell £46 worth of thinnings after ten years and £57 10s. after twenty years, and the whole crop for £400, after 45 years, as a satisfactory result, I presume?—Yes. That gives you 3 per cent. for your money and an annual rental of about 18s. an acre for your land.

1519. Can you tell us whether you consider there are areas of similar land which could be suitably afforested in that part of the country with which you are acquainted?—Do you mean large areas?

1520. Yes, here and there, considerable areas. I do not say large areas in the same place?—If you had the fee simple of the mountain, yes; but you must not interfere with the tenant rights of the mountain.

1521. Do you mean the rights of grazing?—Yes; you must not suppose that you can take the mountain or even buy it for this purpose. If you buy the manorial right of the mountain it does not give you the right to plant to the injury of the tenants.

1522. Is it possible in certain places to expropriate and compensate the tenants for their grazing rights?—No. It is so valuable to the farms below that unless you could buy those farms altogether, buy the whole manor as it were, I do not think you could get that right, and even then it would be extremely unpopular. I do not, of course, know whether this is evidence which ought to be recorded.

1523. (*Chairman.*) It is a very valuable point of evidence if we might have it. I think it is very important as showing that the expropriation would be unpopular?—I do not think it could be done. I think it would be a very undesirable thing to do. It is a different thing planting a small piece of land on the mountain to show your ownership and taking a large piece if you wanted to do it for profit, as you would have to do. I am sure it would not answer.

1524. (*Mr. Lewis.*) But would it not be possible by arrangement with the tenants to plant certain selected areas? It would have the effect of giving their animals more shelter, and at the same time you might make them some compensation?—Yes, but a belt for shelter and a large plantation for profit are two different things.

Lord Glanusk.

24 Apr. 1902.

The manor lord plants trees for shelter, but if you want to plant for profit you must take a large area.

1525. Do you know that landowners have at their disposal at present land which they could plant if they were so disposed, but which, owing to the fact that perhaps they are short of capital, or that they do not know who their heirs might be, or that they want to see some profit from it in the course of their lives, or that they are trustees, and are unable to plant—do you know whether there are such landowners in your experience?—No. I do not know such landowners. We do plant rough mountain fields sometimes, but it must be done with a good deal of judgment. I do not think you could plant Welsh mountains either for profit or from a political point of view.

1526. What part of the country do you specially speak for?—The county of Brecon.

1527. Your personal experience is entirely limited to the county of Brecon?—Yes.

1528. You do not know anything about the Birmingham gathering ground, do you?—Yes. I sold some mountain land to Birmingham which was part of my own estate.

1529. Do you think that could be profitably afforested?—The Birmingham people acquired from me a very large tract of mountain land, I think 14 miles or something of that sort, of which I only had what you call the manorial rights. I believe they bought the rights of the tenants altogether, because the bottom of the valley will be turned into great lakes, and they may have to obliterate the tenant right altogether. That, perhaps, would be suitable land to experiment upon.

1530. They would be perfectly free to experiment if they thought fit?—If they are perfectly free, which is not a fact that is within my knowledge, that might be a suitable place to experiment.

1531. (*Professor Campbell.*) May I ask what is the nature of the land immediately adjoining the four-acre plantation?—It is agricultural land.

1532. There are cultivated fields close up to that plantation?—Yes.

1533. Would not you debit the agricultural land with part of the cost of the fence which is round the plantation? Does not it act as a fence to the cultivated land round about?—I do not know how that may be, and I cannot answer that question. It might be possible that you might plant a field already fenced or something of that kind. It is quite clear that if you have exceptional advantages for planting, such as having no fencing to make and being near a railway station, and so on, then you make a much larger profit.

1534. It seemed to me an extraordinarily high charge for fencing a plantation?—It is about the same price that I observe in Brown's "Forester." He put it at 1s. 3½d. a yard for fencing. You will find that, although mine looks a large sum, it is 560 yards of fencing, and you will be surprised to see how slack people are in calculating a thing out. They do not charge for haulage and for many things. I do not suppose Brown charges at all for the haulage of his fencing, and his book was written many years ago. I think my price is a low one. At all events, if you go into the market and try to buy it at the price I have put it at, I am quite sure you will get it no cheaper.

1535. I think you said that the price of pit props had fallen very much?—Yes.

1536. Does the same statement apply to other classes of timber that you have sold?—I cannot answer you that. I think larch poles keep their price.

1537. Do you think that they fetch as good a price to-day as they did 40 years ago?—I cannot answer that.

1538. But generally you think the prospect of timber growing in your country is very poor?—No. I think you would get 3 per cent. for your money, and I think you would get 18s. an acre for your land, assuming you do not plant in less plantations than four acres, and assuming that they are fairly square, because if you have an irregular outline your fence is much longer, and assuming you have not to protect yourself against rabbits.

1539. But I presume you have to do that?—Then you must add £2 an acre to your expenses, and if you have to do that it takes about half the rental away.

1540. Still, there are good prospects even with that?—Yes; another thing in timber is that you must not of course take this £500 as the gross receipts on four acres. To have that yearly you must, of course, have forty times your four acres, or 160 acres, devoted to larch plantation to get your profit.

1541. Are you extending the area under timber?—Slightly; I replant always. When I have a piece that I can plant with advantage I do plant it.

1542. Are the other landlords in the county doing the same, do you know?—I think so. The lower parts of the mountain, I think, are profitable to plant if you have the farms below in your own hands.

1543. Generally speaking, do you think there is any greater interest taken in forestry now than there was twenty years ago?—No. We live in a coal country, and the planting of pitwood has been always one of our trades.

1544. You think there is no special interest being taken in the subject—is not the subject more talked of now than formerly?—No. We have been always alive to the advantage of it.

1545. With regard to the hill that you planted that turned out unprofitable, what is the nature of the plants that are growing on that hill—heather or bracken?—Heather and bracken. Where these woods were planted I think is below the heather. The heather does not grow with us as low as it does in Scotland.

1546. And there was bracken, too?—Yes.

1547. Had you to make a clearing before you planted?—These trees would be 50 years old when I cut them down five or six years ago, and it is beyond my experience.

1548. I beg your pardon; it was planted by your predecessors?—Yes.

1549. I suppose you are aware that there is considerable difference between the Continental system of forestry and that practised in Great Britain?—No. I know nothing of the Continental system. I shall be very glad to learn something about it whenever your report comes out.

1550. But you have heard that forestry is practised very successfully on the Continent under a different system from that carried on in Great Britain?—It might be so.

1551. Has not your agent spoken to you on that subject at all?—I have no knowledge of it.

1552. He appears to be guided by Brown's book?—I looked into Brown to verify my own figures with regard to the fencing. You must remember that Brown's book was written a great many years ago when labour was very much lower than it is now, and therefore his figures must be taken with caution. Even assuming him to be absolutely right in what he said, his figures are out of date.

1553. Have you ever found it necessary to call in the advice of an expert who knew more of the subject than your forester or your agent?—I do not know where to find him.

1554. And neither your forester nor your agent has called in experts?—No.

1555. Have you not found any reason for doing it?—No. We have never done so at any rate. I do not know where to look for a man. We have been at it all our lives, and my forester and agent seem to know all about it.

1556. Conditions change and methods require to be changed too sometimes?—That is true.

1557. But there has been no change?—I do not wish to be taken as speaking against any amount of education that may be in your mind. All I say is that just for the planting and growing of larch trees experience is the best teacher.

1558. (*Mr. Stafford Howard.*) Do I understand you to say with regard to the plantations on the hills which were not successful, that they were merely planted more as an assertion of right of the lord of the manor?—I think that is so. They were very ugly things put out on the mountain, and I believe they caused a great deal of friction. The people thought it was an encroachment on their rights.

1559. It is a thing that could not be done very largely without creating a disturbance?—No, unless you also had the farms below, and by purchase practically obliterated the rights. If you do that it is lessening

Lord Glanusk.

24 Apr. 1902.

the population and making great changes in the country. I would not counsel it for a moment.

1560. You do not give us, I think, the proportion of the cost of the fencing to the cost of the plantation on the hills. Perhaps you have not got the separate items. I suppose it was a very large proportion?—We could only estimate it, because it was done 50 years ago, and we knew nothing about them. There were 108 perches of walling at 8s. a perch, £43; then we had to raise the stone, haul it to the hill, at 2s. a perch, £10 16s.; labour in erecting 108 perches of wire fencing—partly wire and partly wall—£13 10s.; 15cwt. of No. 5 wire at 11s. cwt., which is the price to-day, £8 5s.; hauling the wire to the wood with two horses and a man one day, 14s.; 2,260 staples at 1s. a hundred, and so on. It has all been carefully worked out, and it came in the one plantation to £93.

1561. It would be impossible, would it not, to have a plantation of land which is grazed by sheep without fencing?—Quite impossible.

1562. And having regard to the capabilities of Welsh sheep, the fencing has to be pretty high and pretty well done?—And then you will not keep the Welsh sheep out.

1563. Is it not a fact that many of those commons are overstocked with sheep?—I think not.

1564. Do you think that the people really keep within the amount that they ought to have, considering the size of their holdings below?—No. I think it is very loosely done, but still I do not think the mountains are overstocked. The custom of the farmer is to stick to the piece of the common above his own farm, which they call "arhosfa," which, I believe, means a resting-place. They drive the sheep up the mountain against their neighbour on the other side, quite up to the boundary. If the sheep go beyond the boundary I suppose they do not mind. If you appear with a dog, every sheep knows its own boundary, and they run back directly. They are what are called settled sheep, and know the hills as well as possible.

1565. Supposing, as Mr. Lewis suggested, it was possible to plant selected areas on these grazing grounds, you could not do that without interfering with the rights of particular farms—you would not be taking a certain proportion from all the tenants, but you would be practically monopolising land which belonged to one or more individual tenants. You see my point, that the mountain, although it is held in common, is really divided up?—It is held in common, and it is practically divided up. There is no fence, and I am not sure that any farmer could claim right to the resting-place.

1566. As a matter of practice if you planted 50 or 100 acres on any of this common land, you would be really interfering with one or more particular men, and not taking a certain proportion from all of them?—Practically, yes, but legally I do not know.

1567. Practically, I mean?—Yes, practically.

1568. Practically you would be interfering with the grazing rights of one or two particular farms?—Yes, that might be so.

1569. Do you know of any areas of this kind that are not subject to grazing rights in the County of Brecon?—I am not sure about the Birmingham area. They purchased the manorial rights, and I think they acquired the tenant rights as well.

1570. Apart from that, are there any of these mountain lands not subject to grazing rights as far as you know?—Not so far as I know.

1571. That must be a standing difficulty in the way of getting any large area for planting?—I think so.

1572. Do the sheep get into any of your plantations?—Yes. The sheep get everywhere: they jump like horses, and they run up a straight wall if it is not too high for them and get over the top.

1573. Therefore plantations a little slow in getting away on exposed grounds would have a worse time of it with the sheep than plantations that got away rapidly on a low ground? They would be exposed to their attacks for longer?—I have not heard whether the sheep would very likely get into the plantation in large numbers.

1574. I suppose you consider that the large profits on the favourable situations to which you refer are within the reach of any owner who manages his woods properly?—Yes. Of course you can only do it to a limited extent, because you must remember you are locking up your capital for 45 years, and losing the rental of your land for 45 years. When you think of 45 years in comparison with a lifetime it is a very serious thing. It can be only done with judgment.

1575. Apart from the locking up of capital, the actual returns are very profitable on suitable situations?—I have allowed 3 per cent. for the money and 18s. an acre for the land. I cannot put it higher than that, and I cannot put it anything like so high if you have to protect yourself from rabbits.

1576. (*Sir John Rolleston.*) I think you said you had given some attention to the rental at which you could afford to plant land?—Yes.

1577. I think you said 8s. an acre?—It was given to me by a very experienced agent as the outside at which I ought to plant it.

1578. If you can get 8s. an acre rental you had better not plant?—You had better not plant. That was his opinion, but I put it still lower. I should not like to plant land that I could get about 5s. an acre for. You cannot use it for any other purpose afterwards. You take it as clean land, and when you leave it it is full of larch stumps. I have had all sorts of accidents which ought to be taken into consideration. I have had trees twelve or fourteen feet high with the tops nipped off by rabbits owing to the snow from the mountains drifting up the side and enabling them to get to the top of the trees. No fencing will provide against that.

1579. You would say from your experience 5s. an acre?—Yes.

1580. If you can get 5s. an acre you had better not plant?—I think you had better not plant if you can get 5s. an acre. Of course it might be a question whether you would plant or not if you could get 5s. an acre, but above that I do not think you ought to plant. In considering it for assessment purposes we put the plantations all round the country at 5s., 6s., and 7s. an acre. I was Chairman of the Commitee, and I think the public thought I put it too low, but I am quite sure I did not.

Mr. D. Robertson.

Mr. DONALD ROBERTSON, called; and Examined.

1581. (*Chairman.*) You are the representative of the Royal Scottish Arboricultural Society?—Yes.

1582. You are a forester at Dunrobin, Golspie, and have had a long experience of forestry?—Yes.

1583. Were you trained originally as a forester?—I have worked in the woods nearly all my life; I do not know that the training was very much.

1584. Have you been abroad?—I have been to Germany.

1585. Do you think that if you had had some of the kind of training which you saw some signs of there you would have been the better for it as a forester?—Yes, very much so.

1586. In your statement I think you attach great importance to the provision of a proper experimental State forest in this country?—I think it is really very much needed as an object lesson to show foresters and proprietors how timber should be grown at all stages of its life.

1587. Do you find that an object lesson is really more important than theoretical training?—Both combined would be better. Theoretical training without practical training or an object lesson is not of much service.

1588. You want the two together?—Yes.

1589. You think all classes need training—owners, factors, and foresters?—Yes, I think so.

1590. All equally?—No, there are exceptions.

1591. I mean that they should all be equally trained?—I think the owner ought to know something about the timber, and then he would be more apt to take good advice from the forester.

1592. He would show more interest in it?—Yes.

1593. I think you are in favour of State forests?—Yes.

1594. You believe there is a large area of land which could be profitably occupied by timber which is now comparatively waste?—In Scotland there is.

1595. You do not know so much about England?—I do not know so much of England.

1596. Have you been through any of the woods belonging to the State in England?—I have been through two of them.

1597. I suppose that as you saw them there is not much to learn there?—I did not see anything much to learn.

1598. You think that a demonstration area or State forest should be begun on the site which was likely to show the best results?—Yes, I think the site should be very carefully selected.

1599. Have you any idea of a good site?—No. I knew a good site some years ago, but it is now occupied.

1600. Where was that?—Skibo.

1601. You think that a site should be chosen where there is broken ground, so that the different methods of transporting woods economically from steep land could be shown?—Yes, that would be advisable.

1602. Have you had any experience of taking timber off hill sides?—Yes.

1603. Are there not methods employed abroad, such as slides and other means, which might diminish the cost of transport?—Yes, there are various other methods, if you had a sufficient area to warrant you in laying down the plant.

1604. You want a large area for a demonstration forest, possessing the different varieties of soil, of hill and of level, so as to demonstrate the different ways of growing the wood and taking it off the ground in the cheapest way?—Yes, if it was possible, but if we had an area to show us how to grow it well it would be better than nothing.

1605. Do you think the manufacturing of wood is as well understood as the growing?—By the timber merchants it is; but I do not say that about the estate management as a rule.

1606. Do you think the forester should have a training in the utilisation of forest products?—I think he ought to know how to utilise them to the best advantage.

1607. Do they generally know how to do that?—I am afraid not.

1608. Are the timber merchants capable men?—Yes, they are so far as I have seen them; they generally try to work the thing to the best advantage, in the cheapest way possible.

1609. Do you think it is to the advantage of woods that the forester should take out the timber from the felling areas, or that it should be done by the wood merchant?—Unless the forester has the necessary experience to take out and manufacture the timber, I think it would be better to sell it on the ground.

1610. For the economical working of the woods, do you think it would be better that the forester should be capable of taking out the wood?—Yes; but if he has not the experience I think it would be better to sell the trees where they stand.

1611. But it would be desirable that he should have such experience?—Certainly.

1612. I believe you think that in well-managed plantations you would find a considerable expenditure on labour?—Yes.

1613. You think as much as 20s. an acre a year would be available for labour in well-managed woods?—If you manufacture the timber it will require all that.

1614. Coupled with the thinning and the planting?—Yes, and the manufacturing and the transport to the consumer.

1615. Do you think that the area of timber in Scotland is decreasing?—Yes, I think so.

1616. And that the quality of the wood is deteriorating?—Yes; I think there are large areas which are classed as woods that are really only skeleton woods.

1617. I believe you have had experience in raising trees?—Yes.

1618. Can they be raised cheaply in home nurseries?—Yes.

1619. Can the new conifers be raised cheaply?—Yes.

Mr. D. Robertson.

24 Apr. 1902.

1620. Do you think the new conifers, like the Japanese larch, or the *Thuja gigantea*, or the Albert could be raised in nurseries as cheaply as larches?—Yes, if you purchase the seed reasonably it grows as easily as larch.

1621. And it is possible to get the seeds at comparatively easy rates for most of these woods, is it not?—Yes, in most years it is.

1622. And you think the growing of these woods in the Highlands is likely to be a profitable industry?—Yes, in a good many of them, in the whole of them I think.

1623. Do you think any of them make good mixtures with larch?—*Douglasii* and larch I have found work fairly well together.

1624. Many of these new coniferous trees grow unusually well, do they not, in the Highlands?—Yes, but you have to select the situation for them.

1625. Do you find fencing a heavy item?—Yes, the fencing is always a very heavy item.

1626. Is it fairly charged to the plantations, usually?—No, I do not think it is. The plantations ought not to bear the cost of fencing, because the trees do not require a fence to keep them on the ground.

1627. We have heard some evidence as to the cost of fencing; what do you find it costs to fence?—It depends very much on the area and the class of fence.

1628. How much does it cost a yard on average ground?—For an ordinary 6 wire fence you have to pay about 5d. a yard.

1629. Creosoted posts?—Yes, creosoted posts and galvanised wires.

1630. With posts at how many feet apart, 18?—I always put them closer than 18. Of course if you run them at 18 you can do it cheaper than that.

1631. In a great many localities posts are put in at 18?—Yes, where you are not exposed to heavy stock.

1632. Wire netting fence against rabbits with three wires is not very much more expensive, is it, than an ordinary 6 wire fence?—I think it adds about 3d. a yard to the cost, that is if you put fairly strong netting on, and it is no use using weak netting. If you have got to make it proof against cattle it adds still more to the cost.

1633. Do you think that the present rents which are obtained from grouse and deer in the Highlands are more profitable than could be obtained for planting on much of the area that is so-called waste?—I think a great deal of the sporting rents might be pretty much as they are, and a considerable area planted.

1634. In your statement you talk of the happy-go-lucky way in which timber is now often sold. Does that mean it is sold when the owner is hard up?—That is so.

1635. Is not that much the same thing as it would be for a farmer to sell his oats green or rotten?—It is pretty much the same as a farmer who has to sell when he requires money; he has to sell for what he can get; but I had another idea in my head when I talked of the happy-go-lucky way of selling. Sometimes young timber is sold before it has probably passed the pole stage.

1636. Is there any reason why pulping should not be introduced into this country?—I am afraid you must find the material first.

1637. But supposing you planted your spruce, you would not object in that case to its being cut early for a specific object?—No, but in these sales that I refer to the subject, to begin with, was thinned until it was much too thin, and then clean cut. I had in my mind's eye about a thousand acres which have been cleared in Inverness-shire recently, which fetched about £11 per acre only.

1638. With regard to the cost of transport, are the woods in the North well laid out as a rule for getting wood out cheaply?—Yes, the bulk of them.

1639. Have you any experience of traction traffic?—Not much.

1640. Is the saw-milling machinery up-to-date?—It might be improved upon if one had enough area to work upon.

1641. Do you think there is much damage done by bad pruning and other forms of mis-management?—Yes. I think there is far too much necessity for pruning really; I think we ought to make Nature prune more than we do.

Mr. D. Robertson.

24 Apr. 1902.

1641.* You believe in the continental method of growing timber?—Yes, I certainly do.

1642. And you would like to see those methods demonstrated?—Yes.

1643. Therefore you hold that the surest way to obtain progress in forestry is to have a good State forest managed on foreign models, demonstrating what can be done in this country with all the different kinds of timber?—Yes. There is an idea amongst the greater number of people, especially with regard to young wood, that when it becomes a regular thicket it should be thinned, when it really should not be thinned. I think a good deal of money has been spent in that way unnecessarily.

1644. You feel that in spite of all your experience in forestry you would have left better work behind you if you had had a thoroughly scientific training?—Yes, or even if I had got an object-lesson to look at before I began.

1645. Do you find many men in your position who are keen to have the advantage of seeing object-lessons such as you wish?—I find a great change in the opinion of the general foresters since that excursion to Germany.

1646. Do you think that the forester on the average estate is left a very free hand to do the best he can with his woods?—No.

1647. You do not think he has sufficient authority to be able to manage his woods properly?—No, not as a general rule.

1648. Is there much injury by game?—Yes, game and squirrels.

1649. Is there any way in which these nuisances could be dealt with by collective action. Do you think it would be possible to have any arrangements by which squirrels could be destroyed, or whether one owner who does not keep ground game should have the right to call upon his neighbour who does to wire net his rabbits off?—I think that is really necessary. In the North of Scotland, particularly, there is an enormous damage done by squirrels.

1650. What is the reason why they are not put down?—I think lack of interest on the part of the proprietor.

1651. Are railway rates high?—Yes, railway rates are high in comparison to the sea rates.

1652. Do you think that traction traffic affords any effective means of competition with the railway companies?—Not for very long distances; for a distance of 10 or 12 or 15 miles it probably would.

1653. That often enables you to get to the sea-board?—Yes.

1654. (*Mr. Stafford Howard.*) What area of woodland are you responsible for now?—About 15,000 acres.

1655. What kind of woodland is it mostly?—There is a large crop of natural birch, and the greater portion of the planted wood is Scots fir, hard wood, larch.

1656. Has planting been regularly done on the estate for years past in proportion to what has been cut: has the area been kept well planted up?—Not for the last 20 years.

1657. It used to be?—Yes.

1658. Do you find that is the case, so far as you know, with other estates in that district?—In a good many estates that is really the case. There are exceptions of course; there are other estates where extensive plantations have been made.

1659. But on the whole do you think the area of woodland is decreasing or increasing in your neighbourhood?—I think it is decreasing.

1660. Largely?—I should say that the cubic contents of timber have decreased very largely. The area nominally under wood may not have decreased so much, but I think that the cubic contents of timber on that area have very much decreased.

1661. Do you think there is room for improvement and need for improvement in the methods?—I think there is very great need for improvements in the methods.

1662. And you are quite convinced that taking the foresters over to Germany to see the methods there has been productive of great good?—Yes.

1663. And there is much greater desire now to consider new methods and possible improvements than there used to be?—There is a desire to grow a better class of timber really.

1664. Better class in the sense of timber that is more marketable and will fetch a higher price?—Yes.

1665. Do you think the timber in this country as so grown would compete very well with the foreign timber?—There is no doubt but that we can grow equally as good timber as they do in Germany, because the old natural woods prove that to us. It was really of a better quality than the Scots fir timber we saw in Germany. The old natural Spey woods, for instance, produced better timber in my opinion than that which we saw grown in Germany. There is no mistake our land would produce good timber if it was grown on sensible lines.

1666. If an area were acquired for what is called a State forest largely for the purpose of demonstration, I suppose that it ought to be in Scotland?—I think there ought to be one in Scotland.

1667. (*Professor Campbell.*) In reply to a question by the Chairman you mentioned something about a sum of 20*s.* per acre. I did not quite catch what it was, but I think it was in connection with labour?—The labour market, really the workers, derive 20*s.* per acre from a good crop of timber that has been 60 years in growing.

1668. It provides 20*s.* per acre for the labourers?—Yes, per annum, spreading all over the time that it has been under timber.

1669. The growing of timber does not then necessitate doing away with all the labourers on the land, does it?—Ultimately it would provide a great deal of labour where there is no labour at all.

1670. Are there many industries usually associated with forests that would keep labourers on the land? I think I heard someone say that such things as clog-making, and a variety of small industries spring up where you have forests?—We have clog makers and bobbin mills where they turn reels for thread works and different sizes of bobbins.

1671. Does that give employment over a large part of the year?—The cloggers and the turning mills work all the year round.

1672. So that owing to the existence of these woods you keep a supply of men at work at these small industries that otherwise would not be there?—Certainly they would not be there if the timber was not there.

1673. You say that there has been a considerable amount of interest taken in forestry in recent years?—Yes.

1674. Has that been due to the excursion to Germany for one thing?—I think entirely so far as we practical foresters are concerned. Of course there has been an interest taken by other gentlemen, such as in Edinburgh, from the educational point of view.

1675. Has there been increased interest on the part of the landlords, the land agents and public generally?—I do not know that there is so very much interest there.

1676. Has the influence of that excursion extended beyond the persons who went?—Yes.

1677. In your opinion it would pay to send a number of foresters over to the Continent?—If you do not provide an area to really show how timber ought to be grown, I think you ought to provide the necessary funds to send your foresters into France or Germany to see how it is done there.

1678. And that money might be saved by providing a forest in this country?—Yes.

1679. You are quite certain that it is absolutely necessary, if interest is to be kept up in forestry, that some means should be taken to provide education for foresters by means of object lessons?—Yes, and if you are to grow good timber.

1680. As a rule, taking Scotland as a whole, is it the forester or the land agent that has the most influence over the woods?—On a great many of the estates in Scotland it is the lawyer in Edinburgh who says "You must sell a certain amount of timber, or, at any rate, you must fetch me so much money," and you have to get it.

1681. It is the agent then, and very often an agent who has no sympathy with forestry at all?—He does not know anything about it sometimes.

Mr. D. Robertson.

24 Apr. 1902.

1682. (*Mr. Lewis.*) Have you paid any attention to the question of the timber supply of the world as a whole; do you consider that the timber we import from abroad is likely in the course of time to considerably diminish?—I do not think it will be very long before it diminishes considerably. I find that the broader sizes of scantlings which used to be obtained some 15 or 20 years ago cannot be had to-day of the same quality.

1683. You regard that as an indication that the supply of timber from which the scantlings were obtained 18 or 20 years ago has become exhausted?—Yes.

1684. And you consider that to be a sign that those portions of the world which are within easy access of rivers are becoming denuded of trees?—That is so.

1685. And that, therefore, there is some prospect that the price of timber may rise in this country?—Yes.

1686. Do you consider that there are large areas of land suitable for afforestation which are not forests at the present moment in that portion of the country with which you have the greatest experience?—There are very large areas.

1687. Do you think that if those portions of land were afforested it would add to the beauty of the country?—It would certainly add to the beauty.

1688. And add to its attractiveness generally?—Yes. It would add to its beauty, and it would add to the labour provided for the inhabitants.

1689. You are in favour of the establishment of State forests to serve as object-lessons to foresters in this country. Do you consider that it would be desirable to have more than one such forest, if possible?—One for Scotland would be quite enough I think.

1690. You consider that the practical instruction given by the inspection of actual results obtained, particularly in countries like Germany and France, is of more value than theoretical teaching?—Without the object-lesson, the theoretical teaching I think has not the effect.

1691. Do you think it would be desirable to organise what one might call assisted tours of foresters in parts of the Continent in which the science and practice of forestry has been carried to a very high and successful point; do you think that that would have a good effect upon foresters generally in this country?—Yes, but I think the forest area would have a far better effect upon the landed proprietors. Unless you can get them to come, even supposing the forester knows how to do it, the forester's education is of very little use.

1692. You think that a beginning should be made with those who have the command of the necessary resources to enable the forester to carry out his work?—Yes.

1693. (*Dr. Schlich.*) I think you told us that you are managing at present 15,000 acres of forest which contain a certain amount of larch, Scots pine, etc.?—Yes.

1694. I think you also told us that the action of yourself from year to year is principally dependent upon the instructions which you receive from the factor?—No, I did not.

1695. For instance, with regard to the cuttings?—I mentioned that as a general practice throughout Scotland, but there are exceptions. For instance, I make the recommendation, and then if my employer or agent agree to it it is done.

1696. And if he does not agree to it?—Then it is not done.

1697. So that practically it depends on what the factor decides or what the factor in conjunction with the proprietor decides?—Yes.

1698. You also told us that very few of the factors understand anything about the forestry business?—There are exceptions, but the majority do not.

1699. I am speaking generally?—Speaking generally the majority do not.

1700. The question of the cuttings is decided from year to year, is it not. You make your proposals every year, and then it is decided what shall be cut in the next year?—So far as the Sutherland estates are concerned I have to make an estimate at the end of each year of what I am going to sell, and what I am going to spend.

1701. You do not make it for 10 or 20 years ahead?—No.

1702. You make your estimate year by year?—Yes.

1703. Are there very great changes from year to year in the quantities of timber which you cut?—No, not since we have got clear of the blown timber.

1704. But in other estates with which you are acquainted, are not there great changes from year to year?—Yes, on other estates which I know they clear off a large area one year, and perhaps if they do not require any money they will not clear anything for another year or two.

1705. And sometimes it occurs that in consequence there is very little more to cut, and you must stop for a number of years?—I am afraid that is the case in a great many instances.

1706. Do you think that this irregularity in the cuttings from year to year has a good effect upon the timber market?—I do not know that it has.

1707. You think there is not much difference?—No. The class of timber we have competes with foreign timber, and there is always plenty of outlet for the supply we have.

1708. Is not it your experience that a good many merchants prefer, as they cannot exactly rely on getting timber locally, to make arrangements beforehand for foreign timber? The timber merchant says "I shall probably require next year, say, 10,000 tons of timber; I do not know whether on the estate within easy reach of me they mean to cut timber or not, and I should be much safer if I made my arrangements at once, and buy it in Sweden, Norway, Russia, or Canada." Does not that often occur?—It does.

1709. That being so, do not you think that it must have a bad effect on the price of home grown timber? If the timber merchant has made his arrangements, and a certain quantity of timber is thrown on the market locally, does it not occur to you that he would not take it unless he could get it at a very low price?—That is so, but I think what lowers the price more is the quality.

1710. Are you sure of that?—I rather think so.

1711. Do not you think it would be possible to make far better arrangements for working up the timber, for transport and everything if about the same quantity of wood was cut every year on the estate?—Certainly.

1712. That would be a very important item in the amount of expenses of working out timber, would not it?—Yes.

1713. It would considerably reduce the expenditure, would not it, in working up if you could have more permanent saw mills, and if you have traction engines or other means of traction. If you knew that you would get about the same amount of timber every year you could work it out at a reduced rate per cubic foot or per ton; is not that so?—Yes.

1714. Do not you think that for all these reasons it is highly desirable that, especially on large estates and even on small estates, there should always be a plan or a working scheme laying down the working for a series of years, so that the surrounding timber merchants know exactly what wood is coming on the market; would not that have a beneficial effect on the price of timber?—It certainly would, and it would be better for all parties.

1715. If you make a plan for a number of years ahead, would not it require a considerable amount of technical knowledge to hit upon the right thing?—It would.

1716. Do not you think that in order to have that knowledge those who make the plans or the working schemes should have a thorough training in the art of forestry?—Yes, certainly.

1717. In other words, you agree that in order to introduce systematic and regular management the people who prepare these working schemes for a number of years ahead require a thorough training, and require to be experienced in the business, and to be thoroughly acquainted with all the requirements which influence profitable management?—Yes, combined with the local knowledge.

1718. Do you think they can get that knowledge at present locally?—Certainly not.

1719. What do they require for the purpose; do you require special institutions?—Yes.

1720. What we call forest schools?—Yes.

1721. If you had to decide on the training of men who, for instance, would ultimately occupy a position like the one which you occupy, what would you suggest

Mr. D. Robertson.

24 Apr. 1902.

as the course of training? I suppose you did not occupy the position you now do at the beginning of your career?—No.

1722. You gradually worked your way up?—Yes.

1723. I suppose it took you a considerable number of years to arrive at the position you hold now?—It took me all my life.

1724. You acquired your knowledge by just beginning as a workman in the forest or woodman?—As a boy planting.

1725. With a spade and so on?—Yes, handling plants in the planting season.

1726. How many years has it taken you to become thoroughly efficient, to manage the estate like the one which you now have charge of—25 years?—30 years.

1727. Supposing you had had at your disposal at starting as a young man the means of instruction at a properly equipped forest school, connected with practical work, do not you think you could have acquired that knowledge in a far shorter period of time?—I certainly should.

1728. Do you believe that the establishment of properly equipped forest schools in connection with practical instruction would be the means of saving an immense amount of time?—Yes.

1729. You would be quicker in a position to manage an estate?—Certainly.

1730. That being so, are you not very much in favour of a very considerable extension of the instructional means available for young men who want to devote themselves to the profession which you follow?—Certainly that is necessary; but there is one thing I always feel a doubt about—as to where they are to get employment.

1731. That, of course, is quite true; you are quite right, but that was not the point I was making at the present moment. I understand that it has taken you, as a practical forester, 30 years to make yourself proficient, by means of which you have reached as good a position as a forester in Scotland as it was possible to attain to?—Yes.

1732. I want you to tell me openly and frankly whether you think you would have arrived at the same amount of knowledge in perhaps a quarter of the time, or a third of the time, if you had had better means of instruction when you were young?—I most certainly would.

1733. Therefore it is of great importance that we should provide proper means of instruction?—Yes.

1734. At the same time you lay great importance on the practical part of the instruction, do not you?—I do.

1735. Would you have the practical instruction before you went to a forest school, or would you go first to a forest school and then take the practical instruction?—If it was possible to have them together it would be better.

1736. If you had a son and you wished to make him a forest manager, would you send him straight to a forest school where he could have a theoretical and practical instruction at the same time together?—Yes.

1737. You would not prefer his being sent for a year or two to a thoroughly competent wood manager, say, like yourself, before he received his theoretical instruction?—I would prefer to have the education, theoretical and practical, going on together.

1738. Have you any idea as to how that is possible?—It is not possible without an area.

1739. Take, for instance, Scotland; you could not have an area at Edinburgh. Would you give the theoretical instruction in Edinburgh and the practical instruction in an area which may be some distance from Edinburgh?—Yes.

1740. Or, instead of having the theoretical instruction in Edinburgh and the practical instruction in an area which is some distance away from the town (because there would be the going to and fro), would you have the theoretical and practical instruction combined in an area somewhere away from Edinburgh?—I do not mean necessarily that you should have the area just outside Edinburgh. You could give the theoretical practice in Edinburgh, and then go out once or twice, or so many times a month to show really what had been taught on the ground.

1741. You might have it in a different way. For instance, you might spend a certain portion of the year in Edinburgh for theoretical instruction, and the other part of the year in the forest?—Yes.

1742. I suppose you admit that the man in charge of the area must be a thoroughly competent forester, do not you?—Yes, he must.

1743. And a great deal depends on whether the man in charge of the forest is a thoroughly competent forester?—Yes.

1744. Apart from the theoretical instruction in Edinburgh?—Yes.

1745. (*Colonel Bailey.*) You said in answer to Prof. Campbell that there were considerable areas of land in the neighbourhood in which you are now employed that are available and suitable for the extension of the forest area?—I do not think I said available; I said suitable.

1746. I meant available from suitability. Can you tell we what are the revenues derived from such lands for shooting and grazing; what are they worth to the proprietor now without any crops of wood growing upon them?—They average, I should say, from 1s. to 2s. 6d.

1747. Is that all the owner gets out of them?—I think so.

1748. That is the nearest estimate you can make?—Yes.

1749. I gather from what you have said that you think that at present, even in the case of woods that are grown more for profit than anything else, the management has not been in the past all that it might have been?—No.

1750. May I ask you to tell us what are the principal faults that you find in it?—Over-thinning.

1751. Can you name any other?—Over-thinning is really the principal fault.

1752. Do the crops generally have an age fixed beforehand at which they are to be cut, or is it not the case that they are just cut at any time that may suit the proprietor?—On a great many estates they are cut when the money is required.

1753. That is to say, there is no fixed, definite idea beforehand of growing the trees of a particular size or a particular quality?—No.

1754. Do you find that it is sometimes the case, particularly in hard wood crops, that thinnings are made again and again until the stock is reduced very much below the amount that it ought to be?—In nearly all cases that is so.

1755. Until in the end, when the trees have become 60 or 70 years old, there is a very poor crop upon the ground?—In many cases there is not a quarter crop.

1756. And very often, when the crop has perhaps been reduced to a quarter of what it should be, do you find the trees are of a good quality?—No, they are rough.

1757. Has not that condition arisen very frequently from the practice of making thinnings and, taking out the best trees instead of the worst; do not they take out the trees which are most marketable and worth the most at the moment?—In many cases that is so, but even in taking out the worst trees they have over-thinned in a great many cases.

1758. In thinning would you not think it was a better plan to look to the formation of a final crop of high excellence rather than to take out good, well-shaped, half-grown trees?—Yes.

1759. That principle has not by any means guided the management in the past?—No.

1760. To that you attribute, partially at any rate, the very poor condition of some of the older woods—over-thinning and taking out the wrong class of trees?—Some of the really old woods are the best woods we have in this country.

1761. Some of them are, but is it not the case that some of the woods are in the condition we have been talking about?—Yes.

1762. Is not there another cause of failure, namely, the failure to replace vacancies as they occur in the young plantations? Is it not the case that in a great many plantations of, say, a dozen years or so, the vacancies caused by rabbits have not been filled up at the proper time, and the consequence is that you have on the ground a crop of young trees of poor quality?—That is so.

Mr. D. Robertson.

24 Apr. 1902.

1763. Due to the fact that the vacancies were not filled up?—That is so.

1764. You said that if a better system of management were introduced it would result, in your opinion, in the production of a better class of timber. Is it not your opinion, also, that in addition to getting a better class of timber on the ground you would get much more of it?—Certainly you would.

1765. The result of this, I understand, may be taken to be that you have on the ground, in a great many places at any rate, timber of a poor quality and too little of it?—That is so.

1766. And that the estates are managed without any sort of system, that you have probably on very few estates a proper gradation of ages so as to enable you to cut regularly from year to year crops of a certain age?—That is certainly the case in many estates, but on a good many also they are so thin that there is very little chance of cutting any more without clearing off the whole.

1767. You said in answer to a question that although the area covered by woods on your employer's land had not been reduced the growing stock had been very much reduced?—Do you refer to the Sutherland land?

1768. I think you said so; you said the number of cubic feet had been reduced?—That does not refer to the Sutherland land, but to the north of Scotland generally.

1769. The growing stock has been very much reduced in the north of Scotland generally?—That is so.

1770. Do you know any estates in the north of Scotland where it will be impossible to continue cuttings regularly, where there is only matured timber, or timber fit for the market, to last for a few years only, and that then there will be a considerable interval during which it will be impossible to cut anything?—There are many such estates.

1771. I would ask you, in conclusion of this point, whether, in view of these facts, that you could grow a much better class of timber and very much more of it, that there is no sort of organisation, that the age gradations do not exist, and that the stock has been so much reduced that there is only enough timber standing on the ground to provide for a few years' fellings, it can be expected that forestry worked as at present would pay?—No.

1772. Do you think that the figures given relating to such management can be taken as any sort of guide as to what might happen if the management was improved?—The present figures, except for exceptional areas, probably would be no guide.

1773. Taking the north of Scotland generally, do you think the results would fairly represent the returns which might be expected from the land if the system was altered?—If you take it over Scotland generally they certainly would not.

1774. Do you suffer from wind?—Yes.

1775. Trees are blown?—Yes.

1776. Are any sort of precautions taken to prevent loss by blown trees?—No precautions.

1777. Not by growing special belts or felling in special ways? Do not they preserve the outside trees of the older woods so that they may shelter the inner trees?—The gale of 1893 got through all shelter belts and cleared the thing entirely before it, shelter belts and all.

1778. Have you ever heard it objected that if a regular system of forestry were introduced the crops would look so formal that the beauty of the country would be destroyed?—I have not heard that.

1779. Do you not think that, supposing a proprietor wished to retain the wild beauty of the woods growing round his house and along the carriage drive leading up to it, that might be arranged for by leaving comparatively narrow belts on either side of such roads, while the ground 50 or 100 yards inside might be managed on a regular system, and that by so doing the wild nature of the scenery would not be interfered with?—I think the whole of the park area could be left practically as it is.

1780. Practically on most estates there is a considerable amount of the existing wood land, apart from the blank areas, that might be planted upon, which could be brought under systematic management without in any way destroying the beauty of the country?—Certainly.

1781. You said you thought one State area would be sufficient for Scotland. In what part of the country would you put that area?—I am afraid we shall have to take it where we can get it.

1782. Do you think any one area you could get would be fairly representative of all the ground of Scotland, the Highlands and Lowlands?—If you had such an area as I speak of, Skibo, I think it would be a very suitable area.

1783. You would get everything there?—Yes; you could grow all kinds of hard woods and conifers.

1784. (*Sir John Rolleston.*) Is your experience confined to Scotland?—As a forester, yes.

1785. I think you said there was too much cutting and too little planting in Scotland?—That is so generally.

1786. Forestry then is neglected even now in Scotland?—Yes.

1787. You mentioned the expression "suitable land." In your experience would you kindly tell me what is suitable land for planting?—I am afraid my theoretical training is not sufficient to tell you that, but if I saw you on the ground I would tell you what to grow.

1788. Lord Glanusk, who was a witness before you, made a money calculation of suitable ground; he said that any land on which 5s. an acre could be made should not be planted?—I think I am inclined to agree with him. If it fetched 5s. an acre for grazing or any other purpose I would not plant it.

1789. Land that is not suitable for cultivation will grow very good timber, will not it?—Yes.

1790. Could not better crops of timber be grown on better land?—I think the finest crops of timber that I have seen in Scotland were grown on land that you could not cultivate.

1791. There would be no better result from planting in good land than from planting in what you call bad land—land that you cannot get much rent for?—The hillsides, which you cannot cultivate, are good land for timber growing, but bad land for cultivation. It is there you get the finest class of timber.

1792. On land that you could not cultivate?—Yes.

1793. It is a happy provision of Nature, is it not?—Yes.

1794. A crop of timber will grow where cereals and pasturage will not grow?—That is so.

1795. (*Mr. Marshall.*) I believe you are on the Duke of Sutherland's estate in Scotland?—Yes.

1796. I think I remember a great many years ago, in the old Duke's time, a large amount of money was spent by the Duke in steam cultivation?—Yes.

1797. For the purpose of planting?—Not for planting: for agricultural purposes. Considerable areas surrounding the areas that were steam-ploughed were planted, but they were all shelter belts, mostly in peat and on very rocky soil; in fact, there was no soil, and a great deal has not done at all.

1798. With regard to growing larch, is it your experience that the larch disease is gaining ground in Scotland?—No; I am rather inclined to think it is on the decrease.

1799. In your experience is a mixed plantation of larch with other things less liable to disease than a pure larch plantation?—I am inclined to think it is; I have pure larch plantations, and there is very little disease.

1800. Of course the disease always attacks the weakly trees?—No, that is not so.

1801. Do not you notice that if the tree has been hurt in brushing, or the bark has been damaged at all, the disease will attack that tree before it will attack a more healthy tree standing near it?—No.

1802. You think that all larch alike, whether healthy or unhealthy, is liable to the disease?—Not all larch. I am inclined to think that larch grown from imported seed is less liable to blister than home-sown seed.

1803. Have you had any experience of the new larches?—Yes, I have had some.

1804. Do you think it is likely to be a useful tree?—It is a very fast grower, and it has no blister as far as I see.

Mr. D. Robertson.

24 Apr. 1902.

1805. What is the greatest age that you have seen them at so far?—About 18 to 20 feet high.

1806. That would be seven or eight years old, or not quite so much?—About six years, I should think.

1807. (*Dr. Somerville.*) You have a large experience, I suppose, of Highland land generally?—Yes.

1808. I suppose that Highland sheep farms are rather an unprofitable undertaking just now?—Yes, they are on the wane.

1809. They have been on the down grade for a considerable number of years?—They have.

1810. I suppose the number of sheep that these Highland farms will keep varies enormously per acre?—Yes, that is so.

1811. I suppose none of these Highland farms are so good as to keep a sheep to the acre?—I am not very well versed in that subject; I would rather not say. I have not gone into the question of sheep farming.

1812. It is a matter of statistics, and I think if we look up the tables we shall find that in a good many cases it requires even as much as three or four acres to keep a sheep?—I have heard it said that it took six acres in Sutherland, but I cannot vouch for the correctness of the information.

1813. I think you are probably pretty nearly correct, and just by way of calculation, we will say that a large quantity of Highland hills will only keep one sheep on, say, five acres, you say six, but we will say five to facilitate calculation. That means that 5,000 acres will only keep 1,000 sheep?—Yes.

1814. Have you any idea of the rent of Highland sheep land? Have you ever heard that there is plenty of Highland sheep land rented at 2s. a sheep?—No, I cannot go into that question.

1815. I know in point of fact that 2s. a sheep is considered a good rent nowadays for a large quantity of Highland sheep land. At 2s. a sheep a thousand sheep would represent a rent of £100 a year, and these 1,000 sheep would occupy 5,000 acres of land, so that a great deal of land is rented at the rate of £100 for 5,000 acres, which works out at about 6d. an acre. I suppose that a great deal of this sheep land is quite suitable for planting trees, is it not?—Very large areas are suitable for planting, but you must not understand that you could plant indiscriminately.

1816. I quite understand that judgment has to be used in selecting the land. Is it within your knowledge that a thousand sheep can be looked after by one shepherd?—I am afraid that is rather too much; he could look after about 500, I should think.

1817. Very well, we will say 500; so that, according to the usual run of things in the Highlands, 500 sheep would occupy about 2,500 acres, and you would have one man employed to 2,500 acres at sheep farming. You say that if land is put under forestry there is about £1 an acre expended on wages per annum?—That is if you have a regular succession of crops.

1818. If you had, in fact, a thousand acres where your trees varied in age from one up to 100 years, your wage bill on those 1,000 acres would be £1,000 a year?—Yes, the wage bill of the expenditure. I include the transport from the wood to the consumer, so that there would be probably freights and railway rates included.

1819. I thought you said that £1 an acre was the amount of wages that the maintenance of the forest, including planting, thinning, and felling, would entail?—What I wanted to say was what an acre of good timber for manufacturing and sending to the consumer really cost at the last clear felling.

1820. You did not take account of planting?—I estimated that; of course, I was not there.

1821. Would you consider now, if you took a moderate estimate, that a thousand acres of forest would employ ten permanent foresters?—If you had it, as you say, on a regular rotation I should say it would.

1822. One man per 100 acres of forest would be a reasonable allowance?—Yes, I think so.

1823. But under sheep farming we only have one man to 2,500 acres?—I would rather leave the sheep farming alone.

1824. It is extremely important that we should have evidence on the effect of Highland sheep farming on the population, and I suggest this figure, which you consider is fairly reasonable. Drawing on your own experience, and taking the case of farms you know, do you think that 10,000 acres of sheep farm in Sutherland would be looked after by about four shepherds?—In some cases 30,000 acres are looked after by four shepherds. But I would not like this to go as being my evidence; I am not well versed in the subject.

1825. I will not press you on the point then; I will only say that it is a common belief that 2,500 acres of sheep land are looked after by one shepherd, and you, from your own experience, say that if the same land was under forestry it would employ one man to 100 acres; that is to say, it would employ 25 men in place of one, with their families. Then in answer to a question from the Chairman you said that netting in forests or plantations against rabbits entailed an extra expenditure of 3d. a yard?—Yes, about that.

1826. I suppose in making that calculation you did not take into account the fact that you would be able to dispense with about three wires if you put on good strong netting?—I did; you will find that good strong netting just now is very expensive.

1827. How much does it run to per yard?—If you get No. 16 gauge I think it will run pretty nearly 3d., or perhaps over 3d., a yard just now.

1828. But you would be able to dispense, would you not, with three wires of the fence?—Yes.

1829. And the three wires per yard would run to about a penny, so that you would take a penny off your 3d. and say it was more like 2d.?—You can practically only do with two wires less, because if the rabbits are very numerous outside you have to put an extra wire to carry the piece of the netting to hang over to keep the rabbits from climbing in.

1830. You say that it costs about 5d. a yard to put up a sufficient fence against sheep?—About that.

1831. Is that with posts 16ft. apart?—No, you could have them closer; I put them from 8ft. to 10ft. apart.

1832. Would posts at 8ft. or 10ft. apart be close enough to put rabbit netting on to?—Yes; you put wooden droppers between.

1833. You can put netting on to droppers on what is known as the Corrymony system of fencing?—Yes.

1834. We have had evidence before us of the cost of planting. What do you reckon it costs you to plant an acre, only taking account of the plants and labour?—It depends very much upon the subject. If you have a subject where there is short herbage, where you can use, say, two years seedlings, or two years and one year planted trees, you can do it much cheaper than you can if you do it with four or five or six year old plants, where you have to make pits.

1835. In the case of the Highland hills the trees are more frequently three years old than six or seven years old, are they not?—Yes. Plants and planting, in ordinary seasons, when plants are to be had reasonably, can be done for about 25s. or 30s. an acre.

1836. That is supplying the plants and the labour?—Yes, putting in something over 4,000 plants an acre.

1837. Do you generally plant by means of the T notch?—Yes.

1838. The planter is accompanied by a boy, I suppose?—If a boy is to be had, but where there is no boy to be had I make the men carry the plants in a bag by their side.

1839. How many plants do you reckon that a man could put in in a ten hours' day?—I have seen men put in 1,500 a day, but I will take it as a general thing from 800 to 1,000.

1840. You would say that 1,000 would be a good allowance?—Yes.

1841. We have been told that in Wales men can only put in 400 a day, so that evidently there must be something different in the conditions there?—Yes; they were probably big plants.

1842. Four-year-old plants?—I am speaking of putting in small plants.

1843. Three-year-old plants, two years' seedlings once transplanted?—Yes.

1844. Do you do anything in the north with a planting iron?—No.

1845. You have never seen anything but a spade employed?—I have seen a planting iron, but I do not care much for it.

1846. How old was the wood in Inverness that you say was prematurely sold at £11 an acre?—From 35 to 45 years old.

1847. Mixed conifers was it?—Principally Scotch fir.

1848. Was the price of £11 an acre due to the poor growth, to the thin stocking, or to the lack of material?—I think there was enough material perhaps for the £11, but it was of a rather rough quality.

1849. (*Professor Campbell.*) You are giving evidence, are you not, on behalf of the Royal Scottish Arboricultural Society?—Yes.

1850. Of course the details are your own, but the general evidence is given on behalf of that society?—Yes.

1851. On their behalf you would say that forestry is very much neglected in this country?—I would.

1852. That there is a want of proper methods?—That is so.

1853. That forestry is a State question, it concerns the State as well as the individual, and that it should have State aid—I mean so far as education is concerned there should be State aid?—I think it is a State question nearly altogether, that the State should really do something in the way of afforesting large areas of our country.

1854. At any rate, there should be State aid?—Yes.

1855. You also agree that there has been a large increase of interest of recent years in forestry, mainly due to the activity of your society?—Yes, that is so.

1856. That there has been a greater spread of literature on the subject?—Yes.

1857. That this increase of interest has done very much to benefit forestry as far as it has gone?—Yes.

1858. That there is urgent need for greater increase of interest?—Yes, very much.

1859. That this could be obtained by State-controlled forests as an object-lesson to foresters?—Yes.

1860. And that a forest school would be desirable?—Yes.

1861. I suppose that the education given there should be cheap, so that it could be availed of by foresters?—Yes.

1862. That is essential, is it not, because the rate of remuneration given to foresters is not sufficient to enable them to pay high fees?—That is certainly so.

1863. (*Colonel Bailey.*) Are you aware that the views you have expressed have been embodied in a pamphlet by the Arboricultural Society and presented by a deputation to the Minister of Agriculture?—Yes.

1864. You knew about that pamphlet?—Yes.

1865. Are you aware that two deputations have approached the Minister of Agriculture, when they have laid the matter before him with this pamphlet?—Yes.

1866. (*Chairman.*) You gave evidence, I believe, before the Deer Forests Commission?—Yes.

1867. Supplementing what Professor Campbell has asked, I believe you there gave in evidence that the planting on forest lands in the Highlands of Scotland is essentially a Government question?—Yes.

1868. You do not think that there will be extension of the existing timber area by private initiative?—No. I think the landed proprietors feel there is a likelihood of Government stepping in and interfering with the management of land, so that they cannot see their way to invest money in it. That is one reason. Another is that a great many of the landowners, in Scotland particularly, have not got the money.

1869. The chief reason is that they have not got the money to do it?—Yes.

1870. And that it will take all the resources they have to improve the existing wood land?—Yes.

1871. Therefore if there is to be an extension of the timber area in the Highlands, and with it the opportunity of labour for the population, it is to State action that you have to look?—I think so.

1872. You said in your evidence before the Deer Forests Commission that there were over five million acres of waste land in the northern counties of Scotland very well adapted for growing timber?—Yes.

1873. You agree that there is a very large area there?—Yes.

Mr. D. Robertson.

24 Apr. 1902.

1874. The waste land in the United Kingdom, together with rough pasture, is put at 16 or 17 million acres; do you think it advisable to have an expert committee to decide the area available for planting?—Yes; if you mean to do anything you would require to have experts to select the areas that were suitable for planting.

1875. They would do that; but to settle the question of whether or not there is much waste land that could be profitably afforested, you would favour the appointment of an expert committee to decide what portions of the waste lands in the United Kingdom were suited for timber growing?—Yes, if there is any doubt upon the matter; as far as I am concerned there is none.

1876. Are you in general agreement that there is a very large area of land available for profitable sylviculture?—Yes, I think it is generally agreed that there is a large area.

1877. But there is sufficient doubt and a sufficient lack of initiative on the part of the Government to render it desirable to have the point cleared up?—Yes, I should say so.

1878. You mentioned in your evidence before the Deer Forests Commission that in the parishes of Alness and Kiltearn in Ross-shire there were, in your estimate, about 25,000 acres of land under sheep which would be capable of growing timber profitably?—Yes.

1879. Dr. Somerville asked you some questions as to the relative amount of employment afforded by timber growing, and by sheep pasture. You know those parishes and you probably know a sheep farm in them, which used to be of about 14,000 acres, 4,000 of which were under timber. On the 14,000 acres how many shepherds were employed, 5 or 6 or 7?—Not quite as many as that.

1880. Say half-dozen?—Yes.

1881. That would be a liberal estimate?—Yes.

1882. When you managed the timber area of 4,000 acres how many men on the average did you have on the timber portion?—They ran from 100 up to over 200 sometimes.

1883. The figures that you have given include all operations, including the big blow of timber at the time?—Yes, during the big blow there would be over 200 men employed.

1884. That shows that a small section of a sheep farm that happened to be under mature wood yielded in your knowledge for many years many times the amount of employment that the pasture land afforded?—Oh yes.

1885. Are many foresters' sons foresters? Do many of the foresters' children follow their fathers' profession?—Not very many that I know of; I know perhaps half-dozen throughout Scotland.

1886. In certain districts of the country might not there be some training for children in botany and elementary knowledge connected with forestry in the primary schools?—Yes, certainly.

1887. You think that would be a good thing?—Yes, I think that is very necessary.

1888. As to getting education for men like yourself, leading foresters, who have to work their way up from the start, your idea is that the young man would have to be able to earn his living whilst he was acquiring his knowledge, unless there were bursaries provided?—That is so.

1889. You would make him work in a Government area?—Yes.

1890. Therefore the perfect system for him would be to have a forest school on that area, so that he could work during the day and take his instruction in the evening in the form of a continuation school?—That would be a better idea.

1891. But for owners and factors, the University classes, with expeditions to the experimental areas, might be the more effective method?—Yes.

1892. So it is possible that two systems might be needed in order to thoroughly meet all requirements?—Yes. I think really what would do most good would be if the agents and land-owners were got at.

1893. That was why I was asking those questions about their education?—When you have got them, and also have given a little assistance to the working forester, you would very much improve the working.

Mr. D. Robertson.

24 Apr. 1902.

1894. (*Professor Campbell.*) That is the general view of the members of your society as well?—Yes, I think so.

1895. (*Chairman.*) When you say that land may produce 20s. an acre of profit, which could go into the owners' pocket for the employment of labour, that would include planting, fencing, thinning, draining, cutting, transport, and manufacturing on the ground?—I think the 20s. only included the labour employed in manufacturing and disposing of the felling. I think the estimate I made came to 30s. per acre, if you took the others. The last clear-felling of a mature crop of timber gave 20s. per acre per year to labour for manufacturing and sending to the consumer; but I estimate that labour got 30s. per year if you include everything from the time it was planted until clear-felled at 60 years old.

1896. In your evidence before the Highland Deer Forests Commission I think you said, "Now, if by planting this land it could be made to yield 3s. to 5s. per acre of yearly clear rental, besides giving from 15s. to 30s. per acre per year to the working classes, is it not the duty of the Government to at least give it a fair trial"?—Yes.

Mr. J. Davidson.

Mr. JOHN DAVIDSON, Secretary to the English Aboricultural Society, called; and Examined.

1897. (*Chairman.*) I observe that you have a scheme of examination for a certificate of proficiency in forestry?—Yes.

1898. Do you find that that is much taken advantage of?—I am sorry to say it is not.

1899. Do you think that diplomas are much valued by owners of woodlands in selecting foresters?—I do not think they have come to that yet.

1900. Have you been abroad yourself?—No.

1901. Do you find that the annual excursions at home do considerable good to foresters?—Yes; they are very instructive.

1902. Do you think that the existing forests in England are being depleted?—I should not say the existing ones, but those that have existed perhaps 200 or 300 years—at least there is evidence I think that they have disappeared altogether.

1903. You think that now forestry is holding its own in point of area?—I think so as far as my observation goes.

1904. And are the plantations improving or deteriorating?—I think there is more interest taken in them than there used to be years ago.

1905. Are they being improved?—I think so; there is more planting.

1906. But you think there should be an extension of forestry in order to take the place of the forests that have disappeared?—Yes, that is my opinion.

1907. Do you think it would pay?—In the end it would pay; in fact, it would pay within a certain number of years. Perhaps not directly, but indirectly.

1908. A well-grown wood will give a return on the land that it occupies, will it not?—Yes

1909. Provided that the trees suit the soils?—Quite so, and that the other conditions are favourable.

1910. You would like to put forestry on a business footing?—Yes.

1911. And you do not think it is on that footing now?—Not as a whole. There may be isolated cases where it is treated commercially, but not as a whole.

1912. Do you think there should be a system of State forests in this country?—Yes, I think it would be an advantage.

1913. You do not think the extension of the existing area will be effected by private owners?—I am afraid not.

1914. And you think one or more of these forests should be available as demonstration areas where experiments could be tried, and the training of foresters could be conducted?—Yes, I think it would be a great advantage.

1915. Do you think that the extension of the forest area would help to maintain a country population on the land?—Yes.

1916. You have had some experience, I believe, in growing timber at high altitudes?—Yes.

1917. Can you give us any examples?—Of course we have timber growing upon the estates that I am connected with, very fair, good timber, at about 1,800 feet above the level of the sea.

1918. Where is that?—That is in the neighbourhood of Alston Moor in Cumberland.

1919. (*Mr. Stafford Howard.*) Is that on the Dilston property?—On the Derwentwater property.

1920. (*Chairman.*) What kind of timber is that?—Both larch and Scotch.

1921. And it pays?—Well, of course it may be doubted whether it pays financially, but there is no doubt that it is a very great advantage for a farm. There is a 4,000 acre farm close to it, and it is the only shelter the farmer has got for his sheep. The timber is now ready to cut down, and is worth £20 or £30 an acre.

1922. You are connected with the wood management of the Derwentwater estates. What other estates are you connected with?—No other estates at present.

1923. What is the area of wood land on the Derwentwater estate?—We only have at the present time 500 acres. Great sales have taken place during late years. The area used to be about 4,000 acres.

1924. Are you replanting at all?—We are making new plantations, but not on a very large scale.

1925. Have you any regular system there of cutting, felling, and planting?—We fell as soon as ever the timber is ready, and we take in waste land too, where it is likely to be a shelter to adjoining farms.

1926. Do you manage the wood land on your own initiative?—I manage the whole of the estates; I am the agent of the estates.

1927. Do you do as you think fit with the woods?—Everything is generally done on my advice. I report everything, of course.

1928. Are you planting more than you cut?—At present we are. We have not very much to cut now.

1929. How much are you planting a year?—From ten to twenty acres, I think.

1930. Do you think that proprietors might plant if money was advanced to them by the State?—I think so.

1931. Under what sort of conditions as to supervision?—I think it would be better to have Government supervision.

1932. It would have to be pretty strict, would it not?—Yes. Private proprietors have their sentimental ideas about woods, and sometimes do not just cultivate them at the proper time, or in the proper way.

1933. They have also their ideas about game?—Yes, of course in the high land they are not much troubled with game, except that it is a prevention to grouse shooting. It stops the drives. That is the only disadvantage.

1934. Have you any experience of planting the gathering areas of water companies or corporations?—No.

1935. (*Dr. Somerville.*) You have been secretary, have you not, of the English Arboricultural Society for many years?—Yes, since its commencement.

1936. How long has that been?—About twenty-one years.

1937. The society has been established for twenty-one years?—Yes.

1938. Have you noticed during that period that its numbers have increased materially?—Very much so, especially during these last three or four years.

1939. Do you think that interest in forestry has been gradually growing, and that during the last three or four years more particularly it has been increasing considerably?—That is so.

1940. To what do you attribute this increased interest in forestry in this country?—There may be different reasons given for it. I do not know that the society may take to itself any credit for it. I may say that the proprietors looked with some suspicion on the society at first. I think they had an idea that foresters were combining as a kind of labour movement or something

Mr. J. Davidson.

24 Apr. 1902.

of that sort; but now that they see it with the pure intention of extending plantations they are taking more interest in it. Of course, a great deal of land during late years has gone out of cultivation, and been laid down to grass; in fact, there is a very large area going back to prairie. Mountain land has deteriorated in value very much, and I think that has been an inducement for proprietors to take up more plantation.

1941. What is the membership of your society now?—At the last annual meeting it was 516.

1942. I suppose that is the largest number the society has yet had, it it not?—Yes.

1943. I suppose that the society undertakes annually excursions to woodland estates?—It does.

1944. And it has not been abroad so far?—No.

1945. But it proposes to go abroad this year, does it not?—Yes, to France.

1946. Do you think that the excursion which the Royal Scottish Arboricultural Society made to the Continent about five or six years ago has had some influence in determining the English society to take a similar course of action?—I think it may have had some slight influence in that direction.

1947. Do you think acquaintance with Continental methods cannot but be an advantage to English forestry?—Quite so. We have now a few more scientific members connected with the society who advocate going further afield.

1948. The English Arboricultural Society holds an examination, and grants certificates in forestry?—Yes.

1949. The Highland Society of Scotland also holds such an examination?—I believe so.

1950. One main difference between these examinations is that the Highland Society's examination is purely theoretical, and I think the English examination is largely practical, is it not?—Yes.

1951. The examination takes the form, partly at least, of putting candidates through an examination in the practical processes of forestry, does it not?—Yes.

1952. They must show skilfulness with the use of the axe, and the spade, and the saw, and ordinary forestry tools?—Yes.

1953. So that I suppose any certificate that would be granted as the result of this examination would be a fair criterion of the practical acquaintance of the candidate with forestry operations?—Yes; it is very important that they should know the practical part of their work.

1954. You say that the number of candidates has not been quite so large as you would like?—It has not.

1955. I suppose that that may be due to some extent to the very searching character of the test that is applied practically?—Yes. The scientific knowledge that they are expected to attain is somewhat difficult for men who have received only a moderate education.

1956. On the other hand, it would be no use I suppose for a student who had gone through a theoretical course of training to present himself for this practical examination?—No.

1957. So that the theorist alone has no chance of passing and the practical man, on the other hand, has no chance of passing, and the result is that we may call it a very searching examination?—Yes. Our society is scattered over a very wide area, and you may get isolated cases where men desire to come up for examination, but it would scarcely do to bring the Committee together unless we had a sufficient number.

1958. What form do you consider education in forestry might best take?—I have an idea that it would be best to have an experimental forest, and to have the teaching there.

1959. You would like to see one or more areas of land acquired by the State, would you not?—Yes.

1960. Which areas should be run on thoroughly practical lines?—Yes.

1961. But at the same time I suppose it would illustrate the various systems of forestry?—That is so.

1962. To do this I suppose the area would have to be of considerable size?—Yes.

1963. What do you think would be sufficient for one of these areas?—Of course, it would depend on the locality. If you go into the higher altitudes, into mountain districts, where you can get land for about 2s. an acre as an annual value, you should not have less than 4,000 or 5,000 acres.

1964. You think 4,000 or 5,000 acres would be a sufficient size for one of these areas?—That is, if the land was judiciously selected. It would not do to take 5,000 or 6,000 acres of moss where, even if the trees grew, the wind would blow them down.

1965. It would be rather desirable to have various types of land represented on such an area, would it not?—It would.

1966. It would be desirable also to have some moss land, and some rocky, bare hillsides?—Yes.

1967. And some land of better quality, of course?—Yes.

1968. Consequently, you would not only advise that the soil should vary, but also that the altitudes should vary considerably?—Yes.

1969. On one of these so-called demonstration areas you would, I presume, suggest that a school of regular forestry instruction should be established for the education of the working forester?—Yes.

1970. I suppose the young working forester is not, as a rule, in a position to pay much in the way of fees?—No, his wages are too low.

1971. How would you get over the difficulty of fees?—There would have to be the same that we have in education, some Government allowance.

1972. Something in the nature of a scholarship?—A free grant, or aid grant, or scholarship.

1973. Did it every occur to you that it might be possible for the student who spent two years more or less at such a school to do a certain amount of work in the woods, and to receive some wages for the time he worked, which wage would be sufficient, at any rate, to pay for his maintenance and education?—I think that might do but at the present time if virgin land was bought up there would be no woods for him in which to work, say, for 20 or 25 years; or very little, with the exception of repairing fences and generally looking after the land.

1974. And planting trees?—Yes.

1975. But there would be no felling?—No.

1976. Would it not be desirable in securing such an area to attempt to obtain land which contained a certain amount of timber already?—It would be an advantage if you could get it partially wooded, even if it were only a small proportion.

1977. But after the area was in fair working order, I suppose it would be possible then for young men to come to such a school and to obtain theoretical instruction in the afternoons, or during a certain portion of the day, and during the rest of their time to actually take part in the practical operations that were going on, and to receive some remuneration for such work?—Yes.

1978. It is within your knowledge, is it not, that the Northumberland County Council has done something in the way of encouraging education in forestry?—Yes.

1979. Some years ago there were classes for the education of working foresters at Hexham?—Yes.

1980. And those classes were conducted one night of the week during the winter period?—That is so.

1981. Hexham is an important centre for forestry?—Yes.

1982. There are large woods in the neighbourhood and extensive nurseries there?—Yes.

1983. And young men came to work in the nurseries, and in the evening they attended these lectures on forestry?—Yes.

1984. Do you happen to know whether the attendance was fairly satisfactory or not?—I think it was very good.

1985. Good classes were obtained and the interest was kept up?—Yes.

1986. Do you think that such a system might in the meantime, pending the creation of these demonstration forests, be extended by other county councils?—I think so. Of course the Northumberland County Council have some practical experience in growing trees at the farm; but there is this disadvantage, that the nature of the soil is of one kind, and you are confined in your description of trees. There is no variation of the soil which would allow the student to see how different kinds of trees would grow.

Mr. J. Davidson.

24 Apr. 1902.

1987. I suppose you have seen these plantations at the Northumberland demonstration farm?—Yes.

1988. Could you describe to the Committee what they consist of?—They are principally experimental plots of Japanese larch, a few pines, and Scotch fir, and the usual larch. Of course they have not been planted for more than 4 or 5 years. The plots seemed to be doing very well. It is a sort of poor clay land all of one kind, not land perhaps that is very well adapted for growing Scotch firs and pines, and those sort of trees, but still they are looking very well, and I believe they are doing very well.

1989. I suppose these blocks of plantation are put down to illustrate certain points in the way of mixtures, different methods of planting, different kinds of trees, and so on?—Yes; and not only that, but the health of the trees as well, which is a very important point at present. The larch disease has deteriorated the plantations very much.

1990. These demonstration plantations that the Northumberland County Council farm I suppose are something like half an acre each?—Yes.

1991. The total area under these plantations being something like 8 or 10 acres?—Yes.

1992. The farm is visited annually, is it not, by large numbers of people?—Yes.

1993. And those who are interested in forestry would naturally turn their attention to an inspection of these demonstration plantations?—Yes, they do so.

1994. In the course of time I suppose it would be possible to see the results of mixing, we will say, beech with larch and silver fir with larch, and the relative merits of the Japanese, German, and Scotch larches?—Yes.

1995. And the relative growth of glaucous and green Douglas firs, and various things of that kind?—Yes.

1996. The land you say is poor, and so far as it goes is quite well adapted for planting, but is it all of the same character?—Yes.

1997. In England there is a large number of these demonstration farms nowadays?—Yes.

1998. Do not you think that that system which has been adopted by the Northumberland County Council might with advantage be carried out by other county councils who have similar farms, but who have not, so far, gone in for any such demonstration plantations?—I think it would be an advantage, because they would have different soils on which to experiment.

1999. It may be also within your knowledge that the Northumberland County Council have not only subsidised instruction in forestry at Hexham and established these demonstration plantations on their experimental farm, but have also granted scholarships to enable young foresters to travel to Newcastle for one day in the week during the whole winter?—I think that was done.

2000. These young foresters were granted scholarships sufficient to cover their railway expenses, and they came into Newcastle and received systematic instruction in the evenings?—Yes.

2001. I suppose that, subject to limitations, these three forms of instruction in forestry which have been subsidised by the Northumberland County Council have done a certain amount of good?—Yes.

2002. They may not take the place of a model forest of a well-equipped forest school, but I suppose you will agree that within their limits they are to be distinctly commended?—Yes, there is no doubt of that.

2003. And, in fact, that other county councils who have not taken these lines might with advantage follow the lead of the Northumberland County Council?—Yes.

2004. I should like to ask you one or two questions as to the relation of population to forest operations. I suppose the land that you recommend for being put under forestry is at present grazing land for the most part?—Yes.

2005. I suppose it is pastoral hill land?—Yes.

2006. And carrying black-faced or Cheviot sheep, as a rule?—Principally.

2007. Do you happen to know how many acres of such hill land it takes to maintain one sheep for a year?—There is such a difference in the land.

2008. I mean the land more particularly adapted for forest purposes?—I think we have a farm of about 4,000 acres, and the stock of sheep is supposed to be 2,000, so that 2 acres would be for one sheep. Then there is a very large quantity of that farm which is moss land, so that is would really take half a dozen acres to feed a sheep.

2009. The number of acres necessary for a sheep in your district of Northumberland would be a great deal less than it would be in the Cheviots?—It may not take more acres I think in our district, because the Cheviot hills are sound, without these great moss breaks.

2010. At any rate, it would take more acres in the Highlands of Scotland to keep a sheep?—Yes.

2011. What is about the rent that is paid by a farmer for sheep?—It will run to about 2s.

2012. He pays about 2s. a sheep?—Yes.

2013. And it takes two acres to keep a sheep; therefore the rent is 1s. per acre per annum?—Yes. I think our tenant would pay less than that, because he lets the shooting for a large sum, and it is all included.

2014 The shooting would not be interfered with by planting?—Grouse shooting would. Grouse do not care for woods.

2015. But, speaking generally, there would be still a fair opportunity for sport?—Yes, there would be still plenty of open tracts.

2016. I may take it from you that this land suitable fo rplanting, is at present rented at something about 1s. an acre?—Yes, with the shooting.

2017. You say it takes two acres to keep a sheep. How many sheep are placed under one shepherd?—I think the man I have spoken about has three shepherds.

2018. Three shepherds on 4,000 acres?—Yes.

2019. We will say then that a shepherd on 1,000 acres would be a liberal allowance?—Yes.

2020. That is the present condition of affairs in pastoral districts. In your district there is, excluding the farmers, a population of about one shepherd per thousand acres?—Yes. They might get an extra man in the lambing season, which, however, is only a month or two.

2021. Do you happen to know what amount of labour a thousand acres of land stocked with trees might maintain?—I was reckoning £5 of labour annually to 20 acres.

2022. That is 4 acres per £1?—Yes, I think that is about what it would cost us.

2023. So that 100 acres would cost £25 a year for labour?—Yes.

2024. That is about half a man's wage?—Yes.

2025. So that it would take about 200 acres of forest land, according to your experience, to maintain one man and his family?—Yes.

2026. But under the system of sheep farming one man and his family can only get subsistence on 1,000 acres?—That is so.

2027. Therefore, even under the unfavourable conditions that prevail in your district, forestry would give the opportunity of maintaining five times the population that pastoral farming does?—Yes. I have some information from the late Receiver of the Greenwich Hospital estates at the time the area of the plantations was 3,000 odd acres. The revenue at that time was £4,000 a year, and the labour, in trades and everything, £1,000 a year, which is a fourth of the revenue.

2028. You have referred in your summary of evidence to the advantage of the State lending money for forestry operations. I suppose you are aware that already there are certain facilities for people who desire to plant borrowing money from Improvement Companies through a certificate of the Board of Agriculture?—Yes. I did a great deal of work 37 years ago with money borrowed from the Improvement Lands Commissioners; but, of course, the rate of interest at that time was 6 per cent., and it could scarcely pay at that.

2029. What would you suggest as a fairly suitable means whereby the State might support forestry?—I think if money could be lent at about 3 per cent. it might be useful.

2030. You think that landlords might borrow money from the State at 3 per cent. and plant trees with it, even although they were aware that for 20 years they would have to pay out 3 per cent. without getting any sort of return?—Some might, but it is doubtful even whether you would get a very large number to go into it.

2031. I suppose you would suggest that if the State did lend money on planting it would require to inspect the work when it was done and require to keep an eye on the progress of the plantation?—Yes, to see that they were not neglecting the work.

2032. You have referred further to the advantage of planting areas from which water is drawn for the supply of towns. Not very far from where you live there are large reservoirs which supply Newcastle with water?—Yes, and others are being prepared.

2033. Is Newcastle likely to take the line of planting a catchment area?—I do not see why they should not. They have purchased the principal portion of the gathering area, and it is now in their own hands, and I think that the increase of the water supply would be materially assisted by trees and plantations; in fact, the whole water supply of the country would be helped by it.

2034. When a corporation purchases a catchment area or gathering area it generally proceeds to remove all the population from it?—Yes.

2035. To prevent contamination?—Yes, to clear away the stock and cattle as much as possible.

2036. In fact, there are cases, I think, of their not only clearing the population off, but clearing the sheep, stock, and cattle as well?—Yes.

2037. That leaves the area absolutely unutilised except for forestry, does it not?—Yes.

2038. What advantage, then, would tree planting have besides supplying timber; would it have an effect upon the supply of water?—I think it would.

2039. And upon the purity of the water?—I think it would.

2040. It would have an effect upon the supply, I suppose, through the agency of the vegetable matter which would accumulate in the ground sucking up the water and retaining and preventing it running off?—That is so. We have thousands of acres in our neighbourhood, and, no matter how heavy the rainfall may be, it runs off; it is all gone in 24 hours. If there were plantations, the leaves of trees and the branches of trees would retain the water, and through the action of the roots the water would percolate into the ground.

2041. I suppose also that if the water did not rush off so quickly there would not be nearly so much silt carried into the reservoirs and deposited?—No.

2042. And the water would be brought into the reservoirs a great deal purer, and would necessitate much less filtration?—Yes.

2043. (*Sir John Rolleston.*) You practise mainly in the North of England?—Yes.

2044. You have a general knowledge of the whole of England, have not you?—I have been in Wales, in Gloucestershire, in Herefordshire, although I have never done much in forestry except in Wales.

2045. But you have been about with your society?—Yes.

2046. Do you find that as a rule there is too much cutting and too little planting throughout England?—We find it both ways. There is too little cutting in some cases. We never, however, find any fault with too much planting. I think cutting is often neglected to the disadvantage of the plantations.

2047. Do not you think that planting is neglected?—I think so.

2048. Neglected generally throughout England?—Yes, generally I think.

2049. All the witnesses have agreed that it pays commercially to plant land which will not produce a certain rental, and that you may grow timber at a profit on such land. Do you agree with that?—Yes.

2050. Most of the estates in England are residential, are not they?—That is so.

2051. Is not the market value of an estate well furnished with wood more than an estate which is bare of timber?—Yes.

2052. So that, apart from the commercial value of the timber, the fact of its growing in profusion on an estate increases the commercial value of that estate?—It does.

Mr. J. Davidson.

24 Apr. 1902.

2053. It must be therefore a good investment for trustees of minors and such people to plant in all cases where the estate has been unduly bared of timber?—Yes.

2054. Because, apart from the value of the wood itself, the market value of the estate is increased by the additional beauty, which is always an attraction in a residential estate?—Yes, and the adjoining land is also improved.

2055. From an agricultural point of view?—Yes.

2056. That is a very important point?—Yes. There is another point that we are apt to overlook. There is a farm now on a certain estate of 400 acres, and that farm is to let, but the proprietor wants a certain rent, say £375. The highest offer a tenant has made is only £325. The tenant says that the fences are very bad, and every fence on the farm he has to keep in order. If a certain acreage of that farm was planted, the tenant knows very well that the fencing of the plantation would be kept by the proprietor, and of course he would be prepared to give a better rent. You will find that that will hold good all over the country.

2057. Therefore a landowner may feel that in planting his estate it is not only the return that he is going to get from the plantations themselves, but that at the same time he is improving the capital value of his property?—Yes, he is; and in the neighbourhood of towns he is making very often valuable building sites after the plantations are up.

2058. (*Professor Schlich.*) Your Society examines in forestry, as you have said: where do the men who come up for examination generally get their knowledge of forestry?—They have a certain syllabus put before them, and they have to read up. They are generally men who are on estates, working in woods, who have a kind of rudimentary knowledge of forestry itself. Of course this theoretical part helps them, and then they are put through the course of practical forestry.

2059. Their knowledge is all acquired by private study?—That is so, with the addition of the lectures that were given under the auspices of the County Council.

2060. (*Colonel Bailey.*) Who gave these lectures at Hexham?—Professor Somerville gave some of them.

2061. How many lectures were there?—I think they were given twice a week for one winter, if not two winters.

2062. What classes did you attend?—I am sorry to say that I did not attend one, but some of my sons, I think, attended them.

2063. (*Mr. J. H. Lewis.*) You have had some experience in North Wales, have you not?—Yes, 40 years ago.

2064. In what parts of North Wales?—I have forgotten the name of the estate, but it is three miles from Mold, and there was another estate in Denbighshire.

2065. From your general experience in that part of the country would you be prepared to say that there are portions of it which could be suitably afforested which are not afforested at the present time?—Yes.

2066. I think in your statement you refer to the depletion of foreign stocks; have you given any special attention to that particular question?—I have read a great deal about it.

2067. But has your Society collected any statistics upon the point, or any evidence?—We have information from a great many foreign countries.

2068. Would it be possible to condense that information in the form of a memorandum which might be sent to the Secretary of this Committee?—I think so. Very strange to say, there was a Forestry Association formed in the United States just about the time the English Arboricultural Society commenced, and we have received all the information from the Department of Forestry. There is a Director of Forestry connected with the Department of Agriculture, and the information we have is somewhat voluminous now.

2069. (*Professor Campbell.*) You mentioned that 40 years ago you had experience in forests in North Wales. How do prices compare now for all classes of wood with the prices then?—They are not so good now as they were then. I know we felled a good deal of oak, and the bark has gone back very much. I do not know that the prices are affected so much as the quality of the

Mr. J. Davidson.

24 Apr. 1903.

timber. There were a great many larch woods in Wales that I had to do with. Larch wood is at equal value at the present time, when you can get good timber, but in mines, iron and stone mines especially, they complain that this bulged part where the disease attacks them breaks off and will not bear weight.

2070. With regard to other woods, you think the prices are much the same now as they were 40 years ago?—No, the price is not so good.

2071. They have all gone down in price?—Yes.

2072. The prospects are worse in that respect?—There has been a rise lately.

Mr. A. Vernon.

Mr. Arthur Vernon, Member of Council of the Surveyors' Institution, Land Agent and Surveyor, called; and Examined.

2073. (*Chairman.*) You have had a long experience of a very large number of estates on which there are considerable woodlands?—Yes.

2074. And you have been concerned in planting, especially in the neighbourhood of the Chilterns, where beech woods are valuable?—Yes.

2075. Do you think there has been a considerable reduction in the area of forests in those districts within the last century and a half?—Within the last half century. They were reduced very largely indeed after the high prices of corn, subsequent to the Crimean War.

2076. Do you think that beech succeeds best when it is self-sown?—That we know to be the case. (*Appendix IX.*)

2077. Is natural regeneration the usual process that you follow?—Buckinghamshire has been the home of the beech, and from time immemorial the woods have been self-planted. Beech trees are more flourishing when allowed to follow their own natural habits of self-sowing.

2078. Is that the system followed?—We do all we can to encourage that habit. We remove the undergrowth and rubbish, and provide for the survival of the fittest.

2079. Do you take the woods on the selection system, or by clean cutting?—By a mixture, but the selection system is the dominant feature. As woods differ so much in productive capacity it is impossible to allow them their exact rotation. Taking a thousand acres of beech wood in the Chiltern Hills district, every beech wood differs in its productive capacity according to the situation, the soil, and the management.

2080. Is most of the area covered by the process of natural regeneration or planting?—Almost entirely by the care taken in that indigenous system which I have pointed out. The beech succeeds best when it is self-sown, and beech woods require special treatment. They should be thick enough to exclude cold winds, but must allow for sufficient sunshine and air, or the young growth is much retarded. There is very little artificial planting of beech.

2081. You find that the gross yield varies from 15*s.* in the worst woods to over 2*l.* per acre in the best managed woods, and that the price of beech varies from 8*d.* a cube to about 2*s.* or an average of 1*s.* to 1*s.* 3*d.*?—Yes, that is so.

2082. You find the larch even more profitable?—Larch, which is grown on an entirely different system, can I think at the present moment be made to pay a larger price than any other wood in my experience, provided it is properly planted, kept from depreciation by rabbits, and in a suitable soil, and not in a cold situation.

2083. These larch plantations cost from 6*l.* to 10*l.* per acre for planting and fencing. Do you consider that a high rate for planting?—6*l.* an acre would be cheap. 10*l.* would be above the average. 8*l.* would be the average in my experience.

2084. You do not think it can be done more cheaply than that?—Yes, from 3*l.* to 4*l.* by planting home-reared stock or once-transplanted stock, but I do not think the ultimate result is so quick or so good.

2085. Is it pitting?—They are planted by pitting little holes nine inches or a foot square and about six inches deep, keeping the roots as near the surface as possible, but sufficiently deep to prevent them being disturbed too much by wind.

2086. Do you slip at all?—Yes, for cheap work; but 40 years experience has shown me that a fair amount of expense in starting pays in the long run by results.

2087. You think there is a considerable area of land which could be properly afforested?—I am sure there are many thousands of acres in the counties of Bucks and Oxford and Herts which are only suitable for the growth of timber, and which might with great advantage be brought back again to timber cultivation.

2088. You would get landowners to plant by enabling them to obtain loans?—That is a suggestion I am not able to give a very authoritive opinion upon, but I think that is one way in which landowners would be encouraged. It is a very unselfish thing for landowners in bad times to spend a lot of money in planting, because unless they are very young men they will see no result for their own benefit.

2089. It would have to be under very stringent supervision, would it not, having regard to the amount of ground game in the country?—There would be three great difficulties I think in the loans. They can be only advanced in instalments, the security might be destroyed by the season, by bad management, or by the ravages of game.

2090. You would propose also that new plantations up to 25 years might be left free of rates?—Yes, they were free of rates until the Act re-imposed those rates. That is a very great hardship, that land that is of no productive capacity, but which the prudent landowner has put down in plantations, should be paying rates for 25 years before it returns a penny. It is contrary to what we used to consider the accepted law that he is rated for what is absolutely a non-beneficial occupation.

2091. Would it bear an extra rate during the latter period of its growth to compensate for not having paid during the first part, or at the felling?—I hardly like to say anything on that. I know it is not the stock that is rated. The difficulty would be that under that Act the land is assessed in its natural condition, whether it contains £200 worth of timber per acre, or is a new plantation worth only £10. In one case the owner is deriving a large annual benefit, and in the other he has to wait 25 years at least, before getting any return on the expenditure.

2092. I see that according to your statement you advocate improved methods of teaching forestry and facilities for woodmen to acquire information, together with increased advantage of easy transit, and think these would encourage owners to add to the value of timber culture?—The cost of moving timber on railways is often a very large proportion of the total value per cubic foot. All those advantages would encourage the growth of timber.

2093. How do you think the woodmen themselves could be better trained?—I am not prepared to offer any suggestion, except this: I have a great many woodmen under me, and I think that painstaking instruction of skilled agents is the only way in which I can see they could be trained.

2094. Do you think the owners and agents should have greater opportunities for acquiring a more technical knowledge of the management than woodmen?—I think they should. I mean that the best woodmen are generally those who have been woodmen for generations. I do not think they can all be taught. A good woodman is generally too old now to be taught; he will obey instructions, but is absolutely beyond theoretical teaching.

2095. Have you had any experience of timber growing beyond beech woods and larch plantations?—I have in many counties in England, but that is the largest practice I have, and on which I think I might offer suggestions to you with more advantage than with regard to other timbers.

2096. Where the beech is grown in these particular districts you think that the local knowledge is sufficient without providing additional facilities for education?—No, I do not. We have some of the best woods in the kingdom on a small scale. The Indian Woods Department come over occasionally to see them, and we have been able to show them beech woods in perfect condition as we think, free from rubbish, containing young trees, middle-aged trees, and old mast-bearing trees, which are ripe for cutting. We think that beech woods should contain trees always to the maximum cubic capacity possible, and in such a period of succession that they might be cut at regular intervals without lessening the annual quantity. If we find, like we do in some of the French forests, that there is nothing but very big trees, we know that that is rearing of capital without any benefit until it is cut. It is a crop and not a succession of crops. If we find bad undergrowth, ruined by rubbish, and not properly cleared, we know there is no attention being paid to it, and that the succession of crops is being destroyed.

2097. I see that in the last page or two of your suggested evidence you give various reasons why you think education is necessary. You think that as far as the facilities for acquiring a thorough knowledge of the management of woodland are concerned, the State could aid, and you think it is more important to provide for the needs of the estate agents than for the woodmen. The woodmen would take their directions, and learn their business from the estate agents?—Yes. Woodmen, as a rule, have such a very contracted knowledge.

2098. It is for the education of owners and agents that you would suggest the State should provide additional facilities?—Yes, except for a few foresters on large estates—intelligent young men, often Scotchmen, but a few Englishmen—I do not know any race of woodmen who would benefit much either by lectures or books.

2099. Foresters on large estates would rank almost with agents?—Yes. On large Cheshire woods I have had a forester who was quite capable of being taught, and an intelligent fellow who would learn anything, but he was quite an exception.

2100. Are these head foresters ever attached to large land agents' offices so that they can supervise several small estates?—I think not. I think a forester is expected to do actual manual work, and he gets attached to one estate. He learns the habits of that estate, and the necessary treatment without being able to compare various systems.

2101. Would it not be possible to manage several small estates by one highly skilled forester?—I think it would be desirable that the estates should be of the same character.

2102. Do you find that the levying of tithe is any bar to plantations?—I do not think I do, but I find that the tithe is complained of after the plantations are planted very much.

2103. The tithe is often quite as heavy a tax, or even heavier, than the local rates, is it not?—It may be heavier; the tithe may be 5s., 6s., or more, and the local rates 3s. or 4s. But the two together mount up in twenty-five years very often to as much, at compound interest, as the total cost of the plantation. In other words, they double the cost of forming the plantation.

2104. Will there be any possibility of having the tithe remitted on the same principle as the local taxation?—That would be a new principle, and I do not see how it is to be done, but I think there is a very strong claim for remitting rates on land that is planted up to the time when it ought to be productive, because since the time of Elizabeth, as you know, there has been no rate except a highway rate charged upon such land until recently.

2105. But the tithe has been always charged?—Yes, and the highway rates have been always charged, but Elizabeth took off all the other rates in order to encourage the growth of woodland. Now we have the tendency on the part of the men who form assessment committees to charge 10s. an acre on all such lands; practically the same price that is paid for the adjoining agricultural land, whereas the woodland is generally a little worse, and it would cost from £8 to £12 an acre to bring it into the same agricultural condition as the adjoining land which is rated at the same amount. So that there is a gross unfairness in the incidence of the Poor Rate now.

2106. I judge from the very interesting tables that you put in that you look upon ash as one of the most profitable of the timbers?—That is so in my experience.

2107. Some of these returns show a very large profit?—In our best woods we can produce over £2 per acre per year for a long succession of years. In the woods on the Hughenden estates, Lord Beaconsfield's woods, which I have managed for twenty or thirty years, small woods, we have been able to produce an average of £2 a year on that 200 acres for a very long period. Lord Beaconsfield took a great interest in the matter personally.

Mr. A. Vernon.

24 Apr. 1902.

2108. That is a gross return?—The gross return.

2109. Have you any idea what the net return would work out at?—The net return varies according to the size of the wood, and the extent of the fences, and the system of upkeep, but I think you would find it cost to sell timber about 15 per cent., including the cost of felling the timber, and other expenses, and then there would be the regular cost of the woodmen. Probably about one-third of that would be the annual cost.

2110. Are you in favour of State forests?—I am not quite prepared to say I am. I do not see much advantage in England. I have seen many of the forests abroad, but I do not think in England we have much opportunity for State forests.

2111. Would you like to have a State experimental forest where the different methods of growing timber could be tested, and where foresters could be trained in Continental methods?—I should very much, but I am afraid our English land differs so much, not only in each county, but in parts of a county, that it would not be the same as in some of the German forests where they have large tracts of the same character of land.

2112. But, nevertheless, it would be desirable to test the soil and climate?—Yes.

2113. (*Mr. Stafford Howard.*) Can you tell me what is about the acreage of the beech woods in the Chiltern districts, taking High Wycombe as a centre?—I am afraid I can only give a general estimate; I should think 20,000 acres or more. I have charge of several thousands.

2114. I suppose High Wycombe is really the centre of the chair trade in this district, is it not?—Yes.

2115. And it is because of the chair trade at High Wycombe that these beech woods are able to show such a profit—or it is largely owing to that?—It was so; but that has been entirely altered.

2116. That is what I wanted to know, whether you have a market with the chair trade, or you have an outside market?—High Wycombe owes its chair trade to the fact that it was nearest to the raw article, the beech wood. But in the last 100 years, during which that chair trade has been growing up, the material has changed, and the proportion of home-grown wood used is now entirely altered. Instead of wholly using beech they do not use ten per cent. of home-grown material for all the chairs turned out at High Wycombe. Over £100,000 a year is brought to Wycombe Station in timber, and certainly not 20 per cent. of home-grown timber is used in the Wycombe chair trade from the whole of England.

2117. Where does the remainder that is produced in that neighbourhood find its market—does it go into any particular channel?—The quantity of timber I mentioned on 20,000 acres would be at once explained by about £20,000 a year.

2118. Then practically all the produce from the beech woods goes to High Wycombe?—Yes. I do not think our whole district would produce more than something like that per annum.

2119. You said just now that you thought the extent of land under beech wood might be very largely increased?—Yes.

2120. Would they find a market for it?—I think so.

2121. At High Wycombe?—Yes, and other places round about.

2122. The beech woods round the Chilterns are managed, are they not, especially in connection with the chair trade?—Yes.

2123. And the rotation is comparatively short because the size of the timber is not required to be very large?—There is a tendency to cut it too small, because there is a demand for small timber.

2124. I understood the rotation was about seventy years in some of the woods I went over—that ripe timber was about seventy years old?—That would be so no doubt. Beech timber we think arrives at maturity on an average soil in from fifty to eighty years; seventy years would be about the average.

2125. What do you think is the maximum cubic

Mr. A. Vernon.

24 Apr. 190[illegible]

capacity that you would expect to get in these woods per acre?—We have decided that in all sorts of ways. I can tell you of a wood where we have had £200 worth per acre. The maximum capacity unfortunately consists of a few very large trees, but that is not desirable in the interests of succession. On a wood belonging to an estate at Beaconsfield, we measured a quantity on an acre, and found it worth over £200; but it was very bad wood, large timber close to the house, the largest I ever knew. That wood represented something like 2,000 cubic feet to the acre.

2126. Would that be the ordinary produce of an ordinary beech wood supplying the timber trade?—No, it would not. Ordinary timber in the best condition ought not to be worth more than from £60 to £100 an acre. That is the best condition the wood can be in, because it grows the timber more rapidly when it is in that condition.

2127. With regard to what you said about the rates, your object in relieving the landowner for so many years whilst the plantation is unproductive would be to encourage him to plant. Otherwise there is no particular reason in doing it, is there? You only suggest it for new plantations?—Yes.

2128. Once a wood is established, it goes on producing a regular income, so that the rate might be fixed and go on regularly?—I think so.

2129. But with a view to encouraging landowners to make new plantations you think the rate might be remitted?—Yes, to encourage them to make the heavy sacrifice of planting.

2130. You would relieve them for a certain number of years?—Yes, because I think it is an unfair burden at present, having regard to the conditions and the returns from the plantations.

2131. Do you think the existing woods are unfairly rated, considering the produce you have told us is got from them?—We are not allowed to consider the produce in rating.

2132. I was only asking you, considering what you get from them, do you think that the present large value which the rating authority puts upon them is too high?—It is not too high if you consider it as produce, but if you take it in its natural unimproved value—in the words of the Act—I think the rate on woodland is more than the Act intended.

2133. In comparison with the agricultural land is it more unfair?—I think so, distinctly. The farmers' sympathy is to keep the agricultural land low, and they think woodlands can bear a high rate.

2134. Perhaps you think it would be fair when relief was given sometime ago to agricultural land that it should have been extended to woodland?—I do.

2135. You think that as regards the beech wood on the Chiltern Hills the management is as good as can be desired for the particular purpose?—No. We have all kinds, good, bad, and indifferent, but I think there are many people there who know how to manage them if they would take the trouble. Too many of the owners do not employ a regular woodman; they shut the woods up and leave the ivy to strangle the trees, and the rubbish to kill the young stuff, and then they expect to find the crop ready for cutting.

2136. There are woods then where improvement might very well take place?—It might very well take place in three quarters of them.

2137. Is that because the owners do not take sufficient interest, or because they want to do it cheaply?—Because they want to do it cheaply, and therefore they neglect it.

2138. If it could be shown that they would gain more by being more careful, and spending more money on the maintenance, they would probably be more careful?—Tenants for life have their own views about annual costs.

2139. Have you any suggestions to make in which the matter might be improved, and they might be tempted to do better?—No, except the general one that I think any educational advantages would have their reaction in the improvement of the woods. It would be very slow, but it would be sure.

2140. You mean in generally calling attention to the question through such things as the report of a Committee like this?—Yes.

2141. And trying to encourage associations of landowners interested in forestry?—Yes. I think landowners neglect it, many of them, from want of attention.

2142. (*Professor Campbell.*) I think you are distinctly in favour of education for the landowner and the agent rather than the forester?—I think it would pay better.

2143. Do not you think that for some of these woods in England it would be desirable to appoint a good forester, and pay him a better salary, and relieve the agent to some extent of that duty? The agent too often has too much to look after?—Where the woods are of a sufficient extent, that is to say anything over 500 acres, for instance, they demand the services of a good superintendent forester.

2144. You have been to the Continent, I understand? Yes.

2145. And you have seen some of the woods as they are managed there?—I have seen woods in every quarter of the world, I think.

2146. I take it that your visits there have considerably stimulated your interest in forestry, and widened your knowledge of the subject?—Yes.

2147. Do not you think that head foresters ought also to go and see such woods?—Yes.

2148. Would it not be desirable to have such woods as you have seen on the Continent in this country where foresters could see them at their own doors?—I am afraid we could never get quite the same as the grand forest of Fontainebleau, and some of the large forests in Germany. We have not the places in England for them.

2149. You are afraid that in England we could not produce such forests as you have seen on the Continent, that you would not be able to produce forests good enough for an object-lesson?—There is something in that.

2150. Is that your idea?—I had not formed a clear idea on that, but I am a little afraid of it.

2151. I think you also expressed the view that the land in Germany was much more uniform?—There are larger tracts of the same character of land.

2152. And, therefore, we could never attain the same results in this country they can get in Germany?—We could not get quite the same object-lesson.

2153. Are there many small local industries associated with the plantations in your district? I have heard about the chair making, which interested me very much, but are there other industries?—There are the usual ones of wheelwrights, who use ash; builders, who use oak and other woods, and all the common trades.

2154. So that the presence of these woods gives rise to a considerable amount of labour and work for people? —Certainly.

2155. And helps to prevent depopulation?—Yes; it keeps men on the land in the winter.

2156. A great deal could be done in that way to prevent depopulation all over England?—A certain amount could be done.

2157. You think it would all tend in that direction? —Yes. I do not think it would be a very large amount, but a certain amount.

2158. (*Mr. J. H. Lewis.*) If people are kept on the land it would tend to a certain extent to improve the national health?—Certainly.

2159. You mentioned that you had seen forestry in different parts of the world. Can you confirm the statement that there is a smaller percentage of land under wood in the British Isles than in almost any other country in the world?—I have so read, and I have always observed so.

2160. Have you travelled in America?—I have been through the Californian forests and the Australian forests.

2161. From the observations you have made abroad, is it your impression that the timber supply of the world is diminishing?—I am afraid I could not say. Of course, I am always reading it. I have seen them cutting in Sweden to an enormous extent when I have travelled there, but it is impossible for anyone to answer your question without statistics.

2162. You mentioned that much land was denuded of timber in the middle of the last century; do you consider the fact that the British Navy is no longer built of timber is a factor in the discouragement of forestry in this country?—Distinctly so, as to oak, because oak is only worth a half now what it was when they used it for the Navy. It may be a coincidence, but it is a fact.

Mr A. Vernon.

24 Apr. 1902.

2163. (*Professor Schlich.*) I think I had the pleasure of meeting you some years ago at High Wycombe, when I came for the first time with the Coopers Hill students?—Yes, you were good enough to go round with us.

2164. You have given us for the Hughenden woods for the last twenty years an average annual income of £2 1s. 10d.?—That means the gross produce per acre.

2165. And you think the expenditure is estimated at one-third?—I think it is about one-third on the average of woods.

2166. That would leave really a net income per acre of 28s.?—No doubt.

2167. I have not been in Hughenden for some time now, but can you tell me from your own experience whether the stock in these woods is now smaller than it was 20 years ago?—I think it is just the same.

2168. That is the impression which I carried away when I was there about thirteen or fourteen years ago?—It has been cut very heavily during the last three years, but even allowing for that I think it is about the same.

2169. In other words, you think that woods treated like the Hughenden woods are capable of yielding, under present conditions, an annual net income of 28s. an acre?—Yes, and that will gradually increase if prices maintain their general rise.

2170. Some little while ago I gave some figures similar to those, and I was not believed; but here we have the thing on your own statement. You give altogether the returns of six woods; I have added them together, and I find the average returns of the six woods is £1 16s.?—I should take 12s. off that for the fair costs of every kind, and that will be 24s. net. I have taken specimen woods, without picking them out, and I thought you would like all the details, because they verify my statement.

2171. I have just taken the six woods, one of which gives as much as £3 2s. 10d., and one as low as 13s. 7d. Those six woods are under your management, are not they?—Yes.

2172. Are they all beech?—Unless others are mentioned they are entirely beech wood.

2173. Now these beech woods are all grown according to what is known as the natural system of regeneration?—Yes.

2174. And you go there at certain times and take out a certain proportion?—Yes. Sometimes six years and sometimes ten years.

2175. You put the wood into proper order, and you have practically no planting, or at least very little?—None at all in a good managed beech wood.

2176. They go on year after year, and they yield a net income on the Hughenden estate of 28s. per annum per acre?—Yes.

2177. (*Mr. Stafford Howard.*) I do not understand this third column in the tabulated statement. What is the meaning of "average price"?—I should think it ought to be the average price per load. It is per load of 25 feet. The local load is 25 feet, and it ought to be so stated.

2178. 25 cubic feet to the load?—Yes, it is very important to distinguish the 25, as it is the local load, and it makes the price double what you might suppose.

2179. (*Professor Schlich.*) You told me long ago, but I should like to get it from you now, that land on the Hughenden estate, supposing it was used for agricultural purposes, would be worth a certain sum?—Certainly not 10s. an acre.

2180. You told me 10s. an acre at the outside 13 years ago?—It is about the same now. It occupies the worst land on the estate for agriculture, the steep hill sides, and has other disadvantages, cold and exposure. May I, however, add that before you could get 10s. an acre you would have to spend £10 on every acre in grubbing, destroying rubbish, and other things, in preparing it for the plough?

2181. I would not compare it in that way, as there is wood on it now; but supposing there was other land with no wood on it, and the question was as to whether it should be used for agricultural purposes or put under wood, what would the price be then?—10s. would be the right price then.

2182. You are actually following a system in these beech woods which has been much discussed, and is known as one of the Continental systems?—Yes.

2183. Of course, people in other parts of England or Scotland might go to the Chiltern Hills and learn a great deal there?—I think so.

2184. They need not in the first place go as far as Germany and France. It is possible they might see there instances where things are still further perfect. But there are some instructive instances in this country where you could see a well managed wood?—Certainly I think so. I think we can find a few, not very big, some in the New Forest, and some of our beech woods.

2185. When I was in High Wycombe there was quite close to the place a wood which was not an example of good management. There was not a beech tree in it more than 20 or 30 years old; you know the wood I mean?—I cannot remember it, but I can find worse instances.

2186. You do not spend much on fencing these beech woods?—Very little indeed.

2187. Nothing on rabbit fencing?—After once starting the woods we do not spend anything upon them, because we keep up the live fences. Our cost in keeping down rabbits is simply what it costs to kill them. We do not allow them.

2188. Under the system of natural regeneration by the seed which falls from the old trees, you need not fence them against rabbits. I think you keep out cattle?—Yes, sheep and cattle. Pigs are supposed to do a great deal of good in a beech wood. They plough up the ground and help to bury the mast, but we never let them in on purpose unless we have a case of very bad open wood.

2189. (*Mr. Stafford Howard.*) But you kill down the rabbits?—The rabbits must be killed. Young beech and rabbits cannot live together. I have known a wood put back ten years in growth by the incursion of rabbits. They will eat every young beech at ten years old, when it is only really a walking-stick.

2190. (*Dr. Schlich.*) I want to bring out once more a point upon which you have already been kind enough to give us evidence. Any extensive means of education in forestry you said was principally of importance to the proprietor and the estate agent?—I think they are most susceptible to useful knowledge.

2191. There are some gentlemen now like yourself who have by experience in the course of time acquired the necessary knowledge, but supposing there were means given by which the general run of estate agents and proprietors could easily acquire some sound knowledge of how forests ought to be managed, then you think it would be quite sufficient if the woodmen working under them were practically trained in the woods themselves; that is your view, I understand?—I think so.

2192. You do not think it is necessary to have special forest schools for the forester?—I see great difficulty in training foresters. First of all, the difficulty is that the old men are not capable of being taught; if you tell them what to do they will do it. Young men take up forestry, and leave it for something which pays them a little more. It is extremely difficult to keep a class of young foresters.

2193. If these additional means for forestry education were given, you think it is more important at the present moment to provide such means for the agent who will have had a higher education, like the proprietors—a very good class of estate agents—and that that would be more pressing than the education of the foresters?—Yes, I think that is the only way to touch the matter, and the cheapest and quickest way. The only way is to get hold of all the agents and bailiffs, intelligent bailiffs, a little below the rank of ordinary agents, and they would be teachable men. Those are the people whom teaching would pay best.

2194. (*Colonel Bailey.*) In answer to Professor Campbell's question as to whether it would not be desirable to bring before the British people interested in woods some woods grown on the Continental system, so that they might see them here instead of travelling to the Continent to look at them, I understood you to say that the objection would be that there was no land available. But that would not apply, I suppose, to the case of such comparatively small areas as might be attached to a forest school for the purpose of practical instruction?—I think that would be very desirable.

2195. You did not refer to that?—No, I think that would be highly desirable.

Mr. A. Vernon.

24 Apr. 1902.

2196. You said, I think, that another objection to the growth of such model woods or demonstration woods would be that the ground was so very variable here as compared with the German ground; but, even supposing that was so, would not that fact rather help us than otherwise, because we should get many varieties of ground on a small area?—I think then you would need a number of these model stations on different classes of ground, and that would overcome my objection.

2197. Supposing the ground to be very variable, this would rather facilitate showing a number of things on a small area. Supposing you had an area of 5,000 acres and had five different classes of ground, you would be better able to demonstrate than if the 5,000 acres were all of one kind?—If you have 5,000 acres I think you would have 50 classes of ground in any part of England.

2198. (*Sir John Rolleston.*) I think you have practised in many counties in England?—Yes, a great many.

2199. In your experience is there too much cutting and too little planting by owners?—Yes. From my personal observation I should say that the woods of England are being cut for profit and being reduced in cubic contents. Planting is not carried on sufficiently. There is a tendency for landowners to overcut their woods.

2200. With the result that the stock of home-grown timber is decreasing?—Yes.

2201. And at the same time there is an increasing use for it?—Yes.

2202. Is a well-planted estate worth more in the market than an estate that has been denuded, apart from the commercial value of the timber itself?—Yes. I think all purchasers of estates are very particular to have ample timber. They like ornamental timber, and they also like to have timber of productive value.

2203. It is a bad policy for the landowner to denude his estate of timber and not to produce it?—A very bad policy, both from the market point of view and climatic point of view.

2204. Why do you think they are so reluctant to replace the timber that they cut down?—One of the reasons, I believe, is the bad times landowners have been suffering from. Every landowner wants to make a large revenue, and has had less capital to expend in the last 20 or 30 years.

2205. Then anything that would encourage the replanting of trees would be of national importance?—It would be very useful to the estate and of national importance.

2206. You said that the beech used at High Wycombe in making chairs was only 10 per cent. of the total used in making chairs. What is the other 90 per cent.?—The bulk of the wood is what is called Canadian and American birch. It is very much like beech in fibre. It comes into Wycombe in planks of convenient sizes at less cost than people pay for the actual home-grown beech, about 1s. or 1s. 3d. a foot. Other kinds of wood are used. A recent trade has sprung up there by which £500 or £1,000 worth a week of chair parts are being sent over, ready to make into chairs, from Canada. Some has been sent also from Stockholm and Sweden. Two firms have started in the district to sell the parts which are sent over for conversion into chairs. The trade is becoming a gigantic size. It amounted to £500 a week two or three years ago, and now it is over £1,000 a week.

2207. (*Mr. Stafford Howard.*) Has it affected the price of your beech?—I have not noticed that it has. I have given you a list of the prices at public auction. Were it not for this large competition and good trade we should expect the home-grown beech to go down rapidly in value.

2208. (*Professor Schlich.*) You also do a great deal in mahogany and rosewood?—The cubic quantity would not be very large, but enormous prices are paid in Liverpool for those. They mostly come through Liverpool. Mahogany, satinwood, and all the fine woods that make up the chairs that go to such places as Maple's, Shoolbred's and some of the large houses come from the woods abroad through various ports.

2209. (*Sir John Rolleston.*) Was the chair trade in Wycombe started because the beech-wood was there?—Yes.

2210. And now 10 per cent. only of home-grown timber is used?—Yes. I am Chairman of the Chamber of Commerce at Wycombe, and we get all the information we can, and that is the information we have got.

2211. (*Chairman.*) Do you think the forestry training that would be suitable for owners and agents could be best given at the Universities of Oxford and Cambridge in connection with some practical experimental forest area?—No. I think you must bring the teaching closer home to the existing men at a cheaper rate.

2212. I do not mean for the woodmen, but for the owners and agents?—That would not benefit men like bailiffs, who would not be able to go through a university career. I think the County Council technical classes and lectures would do a good deal.

2213. And the Forest School?—The Forest School for those able to pass through the course would be very valuable.

2214. You say you think there are a great many thousands of acres to be profitably reafforested, but do you think that the resources of the private owners will not be alone able to effect reafforestation on any considerable scale?—I do not think they would. I think if they were given a little encouragement it would just make many men plant. On behalf of the owner, a man who was very hard pressed in our district, we planted about 200 acres on the estate, and he has been always regretting that he locked up his money and complaining of the loss, and has not planted an acre since. I am concerned for half-a-dozen owners, and when I suggest planting they say "When shall I get any return?" I explain to them, and they say "Is it reasonable? I shall have to pay rates for 30 years, and when I am gone, or getting very old, the return will come in when it is no use to me."

2215. Do you find that the woods give more employment than the same land put to other uses would do?—We used to reckon 100 acres of arable land properly worked required three men. One hundred acres of grass is generally done with one man, and I do not know any woods which take more than one man to 100 acres. I would not break up any pasture land: as a rule there is no pasture land in the district I know that is not too good a pasture to break up into plantations.

2216. It is pure arable land?—Yes, pure arable land. Where it will grow good grass I should hesitate very much to break it up for plantations.

2217. If I might ask for an opinion on a matter which goes outside your district—we have evidence that there are about 16,000,000 acres of waste land and rough pasture in the United Kingdom, and that a large proportion of this could be profitably afforested. If that were proved to be true by an expert Commission, would you in that case object to the principle of the State afforesting such land gradually?—Not at all. I do not think there is any such thing as competition in wood lands.

2218. We import an enormous quantity of wood every year, and you think as far as possible it would be better to grow it ourselves?—There is too much imported to make any landowner rivals as to price. The quantities imported are so enormous that it would not touch the price.

2219. If it be done by the State you would have no objection to the principle of the State trying to make a large proportion of these waste lands productive?—As far as my evidence is of value in that matter I can see nothing against it. If £10,000 worth of timber is thrown upon the market one week it does not appear to affect the value of the timber at all. The proportion sent from abroad is so great that it is really only a matter of choice and convenience whether people buy home-grown or foreign. I do not think the State, if it afforested a large proportion of the waste, would be unfairly competing with any private owner.

2220. Do you think at the same time it might give employment to a considerable number of people?—Yes.

2221. (*Mr. Stafford Howard.*) It would not give more employment if you substitute wood for arable land—quite the reverse?—I understood waste land. If it is waste there is very little labour on it.

2222. But the land which you think might be planted with advantage in your district is arable land, is it not, not waste?—Most of it would be arable land practically left to run riot and wild.

2223. Is there much of that?—Yes, there is plenty of that; but where it is used and cultivated it is generally put down in grass or sainfoin and left 10 or 12 years.

Mr. A. Vernon.

24 Apr. 1902.

2224. Is there any of that kind of land in the market?—Certainly.

2225. Large areas?—200 or 300 acres. I am very much wanting to sell a tract now of that description.

2226. (*Dr. Somerville.*) What is the price you are asking for it?—£10 or £12 an acre, with a very good shooting district close to a grand estate.

2227. (*Professor Schlich.*) This enormous development of the chair factories is simply due to the fact that these beech forests existed there?—Certainly.

2228. So that if forests were created in other parts of the country it is just as likely as not that a similar industry will be developed, because the forests will be there? The chair industry was developed in that particular locality because the woods were there?—I think so. That was the case with the chair trade.

2229. We might expect similar industries in out-of-the-way places if there were forests? It is more than probable that industries would develop in other localities in accordance with the nature of the timber?—I think so, providing that foreign competition, which smothers nearly everything, did not prevail.

2230. But apart from foreign competition?—It is difficult to put that on one side. There are some grand beech forests in the Alps, and yet they have never developed any industry there except charcoal burning. One sees the finest beech there, almost like the parks in France, and they have only developed charcoal burning and a little carving.

2231. Until quite comparatively recent times those woods were all used for fire wood?—Yes.

2232. (*Dr. Somerville.*) How often do the seed years recur?—I am not quite prepared to say, but with the beech trees we keep up we have always planted every year.

2233. Do you have masts every year?—Yes, but in some years more than another. We have a full mast year every third or fourth year.

2234. The seed drops on the surface of the ground and you do not require to take any special precautions for having it buried?—Not at all.

2235. You do not require to have the surface prepared for the reception of the seeds?—We never touch the surface. The rain and storms break the ground into a proper surface for the reception of the seed.

2236. When the beech wood is cleared off entirely the ground is left in very fair condition, is it not, for any other purpose?—It is very rare to clear a wood off entirely except where it is cleared for corn growing, but where it is clear it is full of vegetable matter, which has to be removed or counter-balanced.

2237. You say that larch grows well in that district also?—Yes.

2238. On the same kind of soil?—Yes, in light dry soil.

2239. On limestone?—Yes, chalk.

2240. I remember before the old Committee it was placed on record that the larch could not grow in Ireland because it was chiefly limestone. Now according to my experience larch grows exceedingly well on chalk or limestone. Is that your experience as well?—I do not know much about limestone.

2241. On chalk?—Chalk admirably.

2242. We had it in evidence the other day that quick-grown beech, that is to say, broad-ringed beech sold at a higher price than slow-grown, narrow-ringed beech, but I suppose in the Chilterns the slow-grown narrow-ringed beech receives the better price?—No, I should say the quick-grown wide-ringed beech would sell a little better. The other is the hedgerow timber, which is very hard to work. It is a question of the attractiveness of easy labour compared with rough labour.

2243. In these very close beech woods of yours, where I suppose there is a complete canopy, trees grow slowly?—Our rule is to never have a complete canopy. You cannot grow young beech unless you have sun and air above them.

2244. That does not encourage weeds to spring up on the ground and choke up the young beeches?—Not to a large extent.

2245. You say that 100 acres of wood will maintain one man and his family?—I think every 100 acres ought to have a woodman.

2246. That is about what is usually accepted. I suppose that would be the case where the felling was done by the purchaser?—No, we employ a gang of men for that.

2247. The gang of men would be over and above?—Yes. Over and above the men looking after it all the year, there would be a dozen men in the winter every fifth, sixth, or seventh year.

2248. If the State were going to undertake the felling and planting, 100 acres would maintain more than one family?—Yes, but the others would be there only three or four months in the winter, and they would only go into the same wood, say every seven years.

2249. The working up of this timber in the manufacture of chairs in the neighbourhood must maintain another large increase?—Yes, a very large number.

2250. And I suppose the beech wood output may run to 50 or 60 feet per acre per annum?—Yes.

2251. Do you happen to know how much labour is required in the factory to work up 50 or 60 feet of beech?—That it is impossible for me to tell you. An imitation Chippendale chair might take a man a few weeks to do a cubic foot, whereas he could do several feet in a day with ordinary chairs.

2252. Do you say that the output of beech timber is 2,000 cubic feet?—Not the output, but the quantity upon the soil. 2,000 feet on an acre, worth 2s. a foot, would be £200, and that is the highest quantity I ever knew. That was contained in a very few trees, and all that was left had become giants to the exclusion of everything else, which was very wasteful.

2253. These trees were older than the usual run of trees, I suppose?—We reckoned the trees were 150 or 160 years old. They had had plenty of space, so that they lived longer, but there were very few of them on each acre.

2254. We had a forester before us yesterday who is regarded as one of the leading foresters in England, and he says that he and one of his friends once measured a wood in Germany, and found it contained over 9,000 cubic feet of timber per acre. I suppose such a figure is quite beyond this country?—I may say that I once saw one tree on an acre, and on measuring it found that the one tree contained 50,000 cubic feet, but that is the celebrated tree in California. At 1s. a foot it would be worth a very large sum.

2255. Is there any artificial sowing in your woods?—It is not the practice in the beech districts ever to plant young beech.

2256. Or to sow it artificially?—Yes. It is sometimes sown artificially, but not to any extent.

FOURTH DAY.

Friday, 25th April, 1902.

PRESENT:

Mr. MUNRO-FERGUSON, M.P. (*Chairman*).

Sir JOHN F. L. ROLLESTON, M.P.
Mr. EDWARD STAFFORD HOWARD, C.B.
Professor W. SCHLICH, C.I.E., F.R.S.
Colonel FREDERICK BAILEY, R.E.
Professor JOHN R. CAMPBELL, B.Sc.
Mr. JOHN HERBERT LEWIS, M.P.
Mr. GEORGE MARSHALL.
Dr. WILLIAM SOMERVILLE.

Mr. REGINALD H. HOOKER, *Secretary*.

Professor W. SCHLICH, C.I.E., F.R.S., a Member of the Committee; Examined.

Professor W. Schlich, C.I.E., F.R.S.
25 Apr. 1902

2257. (*Chairman.*) It is hardly necessary, Dr. Schlich, to ask you for the information of those who are present the extent of your acquaintance with forestry, but perhaps I should do so for the sake of the evidence. You have had a long experience in forestry in all its branches?—I have been engaged in forestry since 1859, which makes 43 years. I studied the theory for three years to begin with and practical forestry for four years, and entered the Government service, in the higher branch, of Hesse Darmstadt. Then I accepted an appointment with the Government of India, held various appointments in different parts of the country, and for the last four years I was Inspector-General to the Government of India. In that capacity I visited most parts of India, with the exception of Madras and a portion of Bombay. I was sent on deputation to England to establish a forest school for the Government of India at Coopers Hill in 1885, and on the 1st of January, 1889, I accepted the post of principal Professor of Forestry at Coopers Hill, a position which I have held ever since. I have visited since then most parts of Germany in which forests are situated, considerable portions of France, parts of Austria and Belgium, many places in Ireland, and also the Highlands of Scotland, and various parts of England.

2258. You have formed very definite opinions, as we know from your writings, with regard to the timber supply of the world. Could you give us any information with respect to the resources of the British Empire and Britain itself in particular?—With regard to the British Empire, of course my information is based on the supply of the world generally. I have handed in an extract from a paper (*Appendix II.*) which I read at the Society of Arts a little more than a year ago, in which all the detailed figures referring to this question are contained. First of all, I may mention just quite shortly that the deficiency of the imports and exports in Europe generally amounts to about 2,600,000 tons every year. Of that I have traced to the countries from whence it comes 2,300,000 tons. The remaining 300,000 tons I have not succeeded in tracing. With regard to the British Empire itself, I have shown from official records that during the period 1895 to 1899 there was a net import into the British Empire of timber worth £17,850,000 annually, while the annual net imports for 1890-4 were £13,994,000, or an increase over the former period of £3,856,000, or an annual average increase of £771,000. The average annual increase in the previous five years, 1885-1889, compared with the period 1890-4, was only £382,000, so that in the last five years the net annual increase had exactly doubled. I must next mention that the principal imports into the United Kingdom of Great Britain and Ireland amounted to £17,595,000 in 1890-4, and that had risen in 1895-9 to over £22,000,000. The extraordinary fact which I want to bring before the Committee is the large number of British possessions which import timber. The countries importing timber are Great Britain and Ireland, New South Wales, Victoria, South Australia, Ceylon, Mauritius, Natal, the Cape of Good Hope, Jamaica, Barbadoes, Trinidad, and British Guiana. The exporting countries are Queensland, Tasmania, Western Australia, New Zealand, British India, the West Coast of Africa, British Honduras, and the Dominion of Canada. Out of the total export of these countries, the Dominion of Canada is answerable for no less than £4,635,000, and the rest altogether for only about £1,000,000 worth. I do not know whether I have properly answered your question.

2259. I think the only thing that I can ask as a supplementary question would be whether you think that rate of increase in the timber to which you allude is likely to continue as far as British imports are concerned?—These imports always go in certain waves. When there is a great development in industry generally the increase is great, and if there is a depression in trade the imports generally sink again. But I wish to point out that as far as England is concerned, although there are ups and downs, there is a steady increase. I shall give you the exact figures with regard to Great Britain and Ireland. In 1864 the imports amounted to 3,396,000 tons in round figures. The next figure from 1864-8 is 3,528,000 tons annually; in 1869 to 1873, 4,459,000 tons; and in the next period, 1874-8, 5,844,000 tons. Then there comes a slight relapse in 1879 to 1883, when the imports amounted to 5,789,000 tons. Then in 1890-4 there is a further rise to 7,628,000 tons; in 1895-9 it was 9,290,000 tons; and in 1899, only one year, the amount was 10,008,000 tons. Therefore you will see there has been a steady progress. I should like now to give you the figures for Germany as bearing on the subject. The figures are for practically the same period. During the years 1842-1864 the imports and exports of Germany nearly balanced. In the whole of those 22 years there is an average annual import of 13,000 tons—practically nothing. In 1865, which is the commencement of the period for which I have given the British figures, the imports jumped up to 913,000 tons—net imports. Then I will go on to give it you for every five years. In 1870-1874 the mean annual net imports were 1,992,000 tons, after that come the years when the great collapse in German industry occurred, some years after the French War; in 1880-4 it was 1,186,000 tons, a considerable drop; then a rise came again in 1885-9, 2,075,000 tons; in 1890-4, 2,796,000 tons; in 1895-9, 3,200,000 tons; and in 1899, the one year only, 4,600,000 tons, about half that of Great Britain and Ireland. That is of special importance with regard to our timber supply, because you will observe that Germany will be a great competitor with England in the Baltic. I may mention that of the timber which Germany has imported latterly, about 1,883,000 tons came from Austria-Hungary, and 1,831,000 tons from Russia, while comparatively smaller quantities came from Sweden and Norway, 570,000 tons, and North America, 262,000 tons. The difficulty is that Austria-Hungary, I have every reason to believe, will not be able to continue, beyond a limited number of years, to export at the rate which it has done lately. It has been stated officially that the stock in the Hungarian State forests is something like 30 per cent. below the normal amount, and it has been decided to reduce the output of the Hungarian forests so as gradually to bring the forests again up to their normal condition. With regard to the rise in Austria proper, data do not enable me to draw a conclusion with the same certainty, but still I think I have enough information at my disposal to say that, even from Austria proper, the exports cannot last beyond a certain number of years. I have shown that in this way:—The average consumption of timber in Great Britain and Ireland amounts to about 14 cubic feet per head of population; in Germany it amounts to 18 cubic feet per head of population. The

Professor W. Schlich, C.I.E., F.R.S.

25 Apr. 1902.

whole production of the Austrian forests is only 19 cubic feet per head of population. Considering that the growing stock in a large portion of the country is already below par, it stands to reason that when industries have been developed in Austria to something approaching their state in Germany, and they are developing rapidly, Austria-Hungary will probably require, after a certain number of years, the whole of its timber supply. Assuming this to be correct, Germany must go somewhere else for its timber. It has already drawn nearly half its supply from Russia, and of the rest some 570,000 tons from Sweden and Norway, and it will have to fall back more and more on the Baltic, or, if possible, North America. I wish here to give some information which I have only gathered during the last fortnight. I went to see the head of the Prussian Forest Department, and he informed me that according to the inquiries which he has lately set on foot, he has come to the conclusion that in the Russian Empire, which is really the crux of the whole business in this case, only 25 per cent. of the country has more forests than are required for home consumption. About 25 per cent. of the country has just about what it requires, and 50 per cent. of the Russian Empire has less forests practically than are required for home consumption. He, moreover, informed me that from inquiries made of the large timber merchants who go to Russia to buy up forests and export the timber to Germany, he has ascertained that a reverse current has set in; that they now sell a considerable portion of the timber which they cut to be transported into the interior of Russia, because they can already get better prices there than they get by exporting to Germany. I consider that a very important statement, especially as it comes from the head of the Prussian Department.

2260. It is sometimes assumed that timber is continuously being displaced in certain industries by the use of metal and other substances. On the other hand, there must be, from the figures which you have given, a sufficient number of sources of new demand to maintain the need for imports?—I have compared the increase in the population of Great Britain and Ireland for twenty years, and I find that during those twenty years the increase in population is exactly 20 per cent. The percentage of increase in the imports of timber during the same twenty years was 45 per cent. In other words, now every inhabitant of this island consumes more timber than every inhabitant did twenty years ago.

2261. Having dealt with the question of imports, will you give us your views regarding the afforestation of surplus areas in Britain?—May I say just two words about North America?

2262. Certainly; that would be most interesting?—Of the total imports into Great Britain and Ireland, conifers comprise 87 per cent. of the tonnage, and only 13 per cent. are other woods. The only sources of a large supply of conifers are the countries round the Baltic and North America. A moderate amount comes from Tasmania, but it is not worth mentioning; it is such a limited number of tons that it does not count. There are also believed to be extensive forests in the back part of the Argentine Republic, but it appears that for a long time to come the difficulty of getting it out is so great that the Argentine Republic at present imports its timber. It is also believed that there are certain extensive forests in the western part of China round about the headwaters of the big rivers; but, on the other hand, it may be said that as soon as the trade and industries of China have developed, China will find it absolutely impossible to supply itself with timber, and will have to call largely on Western North America, and possibly on Asiatic Siberia. So that practically, as far as we are concerned, the two great centres of supply are the Baltic and North America. With regard to the Baltic I have given you some data. As regards North America I wish, first of all, to point out to you that it has been proved by an American authority that there is a deficit. For instance, it has been proved of late years that, even making a liberal allowance for the annual increment in the forests in the United States, they have consumed about 33 per cent. more timber than the annual growth, although there is still a considerable net export from America, amounting, I believe, to 1,000,000 tons. On the other hand, a very large proportion of timber is already imported into the United States from Canada. Looking at the returns of Canada, we find that during the years 1870-1879, 58 per cent. of the exports went to Britain and 33 per cent. to the United States. During the ten years 1880 to 1889 the export to Britain had fallen to 49 per cent., while those to the United States had risen to 42 per cent. During 1890-1899 the percentage of exports to Britain had further fallen to 48 per cent., and those to the United States had risen to 46 per cent., so that practically the United States get already as much timber from Canada as does Great Britain. With regard to the United States, the value of the average annual total exports amounts to £6,043,000, and out of that they reimport from Canada £3,490,000, leaving a real net export of only about £2,553,000. As regards Canada itself, the extraordinary fact is that the exports during the last 30 years have been practically stationary. I can only give you the value of the exports. In 1870 to 1879 the average annual exports were £4,536,000; in 1880 to 1889, £4,477,000; and in 1890 to 1899, £5,247,000, a slight increase in value, but at the same time, as it has been proved that the price per ton during the last ten years has been somewhat higher than it was before, it is probable that even a little less was exported during the years 1890 to 1899 than in the previous two periods of ten years. Therefore you may say practically that the export from Canada has been stationary. I may add that if Canada were to decide at once to introduce systematic management of her forests by selecting, say, 10 per cent. of her forests, converting them into permanent State forests—and they all belong to the State at present—managing them on rational principles, Canada could probably supply the whole world with coniferous timber, as the acreage is so large. They have something like 800,000,000 acres of forest land, of which about 266,000,000 acres may be classed as timber forests. They have only to select from 10 to 15 per cent. of their area, and putting that at once under systematic management, letting the timber dealer have the run of the other 85 per cent., according to the present conditions, and they could probably, at a time when the rest of the forests were exhausted, secure from the reserved State forests a sufficient supply of coniferous timber for the greater part of the world. But Canada is independent. Still, the suggestion might be made.

2263. Do you think there is likely to be a shortage unless all the Canadian forests are put in order?—Yes. Canada is the key to the whole business, because there we have a great stock of coniferous timber, which is what I call, amongst timber, the "staff of life." With regard to hard woods, I do not think we need trouble ourselves at present, because there are large stocks, and if one particular kind of hard wood should give out, others could be made available. There are very large stocks of hard wood in South America and in Australia. Therefore any shortage of the harder, heavier woods might be made good from other sources. But there are no other sources to any extent worth mentioning, except those two great centres round the Baltic and North America, for coniferous timber, and the United States will require every stick they can produce, and probably more, unless they persist in the measures which they have taken of late for establishing forest education and declaring reserve State areas where it is still possible. I do not know whether the Committee is aware that there are forest faculties at three of the principal American universities, and instruction is given at about 40 other educational establishments, conveying a more simple instruction in forestry. In the three colleges there is, I think, a degree in forestry.

2264. Before the Canadian forests could be put into proper order you think there is a possibility of a timber famine?—They have in Canada a forest revenue of very nearly £1,000,000 now. If they were to devote half of that sum for a few years to the establishment of these State forests, and bring them under proper management, it would not mean that those reserves were actually shut up. Over and above the material taken out of the open forests, the reserved forests would yield at once a certain quantity of timber and after a certain number of years, they would be gradually able to make up any falling off which might occur in the outside areas. I should say that in the course of 30 or 40 years they might be probably brought up to full bearing, yielding thereafter enormous quantities of timber and other forest produce, and a revenue many times that which the forests now give.

2265. Do you think that the price of wood is likely to rise within the next 30 or 40 years?—I have gone into that question so far that I have acquainted myself

Professor W. Schlich, C.I.E., F.R.S.

25 Apr. 1902.

with the average value of all the imports into Great Britain and Ireland during the last five years. I may mention that I have generally examined the question for a good many years back, and I find that, beginning about the year 1870, or a year or two afterwards, owing to the development of means of transport, the price of timber gradually fell and continued falling up to the period of 1886 or 1888. At that period it began to get stationary, and remained so for about six years, but there began an appreciable rise in about 1894. I have calculated that from the middle of the period 1890-4 to the middle of the period 1895-99, as regards Great Britain and Ireland, the mean annual increase of imports in tons amounted to 4·4 per cent., whereas the increase in the value was 5·2 per cent. In other words, the value has risen more rapidly than the tonnage. From these data I have calculated that this represents an actual increase of 18 per cent. in the price of imported timber. I have also taken the coniferous timber by itself, which amounts to 87 per cent. of the tonnage, I have calculated the average price for the years 1895, 1896, 1897, 1898, 1899, and I find that it was as follows: In 1895, £1 17s. 7d.; 1896, £1 19s. 10d.; 1897, £2 2s. 2d.; 1898, £2 2s. 7d.; and 1899, £2 3s. 2d., which represents, on coniferous timber by itself, an increase of 15 per cent. in five years.

2266. Have you any further points in connection with imports to lay before the Committee?—I do not think so. Full details are given in the paper, which I have handed in.

2266*. (*Professor Campbell.*) The paper you read at the Society of Arts, I understand, will be printed in the evidence?—Yes, in a somewhat reduced shape.

2267. With regard to the afforestation of surplus or waste areas in Great Britain, do you think there is a considerable field for operations open there?—My personal opinion is that there is a considerable field. At the same time, it must be always remembered that to afforest land leads to a certain amount of inconvenience to the surrounding population. But I do not see why that should not be overcome. I do not advocate for a single moment the afforestation of areas now used for agricultural purposes, but I think there are sufficient surplus areas in this country which may be made available for afforestation, to such an extent that probably most of the temperate timber which we now import may be produced in this country. I have shown that, roughly speaking, there is an amount of land, which includes inland water, of something like 14,000,000 acres in this country which is not accounted for in the agricultural returns. It is waste land. Supposing we take a couple of millions off for inland water, roughly speaking there are something like 12,000,000 acres of land practically not accounted for. Some three or four years ago I examined the returns for all the counties around London within a circle of 50 miles, and I found there were 770,000 acres not accounted for.

2268. (*Mr. Marshall.*) How many counties were there?—It was within a radius of 50 miles from Charing Cross. I am sorry I did not bring the statement with me.

2269. (*Mr. Stafford Howard.*) Not accounted for in what way?—I could not find out what it was used for at all. I only mention that as an example. The areas of so-called surplus or actual waste lands in England are about 4,000,000 acres according to the returns, in Wales about 700,000, and in Scotland about 4,200,000 acres, or a total for Great Britain of about 9,000,000 acres. Ireland has about 5,000,000 acres of such land. But, besides that, there is what is called mountain and heath land used for grazing. That in the agricultural returns is entered at about 12½ million acres. It is quite impossible to say how much of that land might be available for afforestation or suitable for it. I think I must leave Ireland out, and say that there are in Great Britain about 9 millions actually waste lands and about 12½ millions of mountain and heath land used for grazing, or altogether about 21 millions. Of the mountain and heath land there are nearly 2 millions in England, about 1 million in Wales, and about 9 millions in Scotland. As I say, there are of course difficulties in the way of making land available, even land which is now used for so-called light grazing. If, however, the Corporation of Liverpool has succeeded in clearing the catchment area of their water, of all rights, etc., I do not see why, if it was considered necessary for the welfare of the State as a whole, it should not be possible to acquire other areas in a similar way, provided it is not done in a harsh way.

2270. (*Chairman.*) As there seems to be some uncertainty as to what proportion of this waste and heather area is available for proper afforestation, would you favour the appointment of a small Commission of experts to consider and report on the matter?—I consider that one of the most important steps to be taken. The small Commission of two or three should inquire county by county, or part of county by part of county, what areas could really be made available for prospective afforestation. Of course general statistics are all very well; but in the long run they do not prove much. Unless you make a minute inquiry from county to county you are always met by the reply: they may be there, but are they available? A small committee to make an inquiry county by county is the most important step that could be taken.

2271. What are your views as to the financial aspects of afforestation of surplus areas?—As regards the financial aspect, of course we are, as far as Great Britain is concerned, in a very peculiar position. Any data which we have with regard to returns suffer under two great drawbacks. First of all, by far the greater part of the areas under forest in this country have not in the past produced as much timber as they could produce if properly managed; and, secondly, the returns which are at our disposal are mostly a little haphazard. I think Mr. Drummond, who is coming here to-day, might be asked on that particular point, because he is the manager of large estates, and I think he will tell you that these returns are worth little or nothing to him, that they are never above suspicion, so that anything that may be based on the returns we have at present, with the exception of very few like those of Mr. Vernon's yesterday, should be always considered with some suspicion; first, because the areas have not been fully productive, and, secondly, because they are made up in a way which does not actually show what forests actually can do, as there are other accounts mixed up with them. I had, for instance, to go into the matter in connection with a forest of one of the largest proprietors in this country, and I found, as we heard yesterday, that a considerable part of the expenditure was due to the laying out and maintenance of grass rides, over which you can drive a carriage and pair. There are enormous amounts spent for fencing which are not chargeable to the forest, and so on. Of course I need not say anything more about that. The expense is quite justified from the point of view of the owners, because they want to realise certain objects, and the desire of the proprietor of the forest must govern the matter. I am a little loth to introduce data not referring to this country, but if you will allow me I shall give you a few data from a Continental country, the kingdom of Saxony, which in many respects, according to my idea, is the one to be studied by those who are interested in forestry in this country, because there is a high state of development of industry there, and the Saxon forests produce chiefly what we want in this country, enormous quantities of coniferous timber. I have brought a few data, and I shall be most happy to give minute data with regard to that matter afterwards if desired. A thoroughly systematic management commenced in the Saxony State Forests between the years 1811 and 1831, and reliable data begin to be available from the year 1817. The Saxony State Forests have slightly increased since then, from 354,000 acres to 412,000 acres, an increase of about 17 per cent. Now, taking the whole of the Saxony State Forests, the average quantity of timber taken out of these forests per acre annually, between the years 1817 and 1820, was 41 cubic feet. Between 1884 and 1893 it was 69 cubic feet. For not quite the same period, but between the years 1844, when we have the first complete measurement, and 1853, the stock of timber standing on the area of the Saxony forests averaged 2,128 cubic feet per acre.

2272. (*Dr. Somerville.*) Calliper measure? — Calliper measure.

2273. That is to say, if we convert these into English figures we must decrease them?—Yes, but that is not the point. The point is that I desire to show there has not been over-cutting. In 1844 the average per acre was 2,128 cubic feet; in 1893 it was 2,618 cubic feet, an increase from 2,100 to 2,600, while at the same time this large increase in the cutting took place. You see the point now, I think. With regard to the money returns, in the first ten years, 1817 to 1826, the total annual receipts were 7·3s. per acre, whilst the expenses were 3·3s. per acre, the net receipts thus being in 1817 exactly 4s. per acre per annum. In 1893 the total receipts were 28·07s., the expenses were

9·67s., and the net receipts for the whole of the State forests, good, bad, and indifferent—and there are a good many indifferent ones, as they go to 3,000ft. elevation—were 18·40s. per acre. I wish to say here that the increase in the net receipts was 361 per cent. Now you may say, What about the price of timber? In 1817 to 1826 the average price per cubic foot was 2·04 pence, in 1893 to 1894 the average price was 4·08 pence, representing an increase of 129 per cent. The net receipts have increased three times as fast as the rise in the price per cubic foot, due to improved management. May I supplement that by one particular range? I have selected one of the ranges which is by no means the best. Is is a district called the Antonsthal Range, an area of 4,072 acres, managed by a highly trained forester, situated in the Erzgebirge, between an elevation of 1,500ft. and 2,700ft. above the sea, being on slopes with eastern, western, and southern aspects, on granite, mica, schists, and eruptive rocks. The soil, except on southern aspects, is generally loam, but in the higher parts shallow and frequently covered with heather. Distinguishing between four quality classes of soil, and calling one the best and four the least, the average quality is 2·7. It is, therefore, between the second and third quality. The species grown there are 93 per cent. spruce, 3 per cent. silver fir, Scottish pine and beech, and 4 per cent. blanks, for certain reasons. The growing stock in this forest in 1839 averaged 2,100 cubic feet per acre, and in 1893 it was 3.276 cubic feet. The receipts per acre were 48·3s., and the expenses 10·3s., the net receipts being 38s. per acre per annum. These are forests situated, as I said, between 1,500ft. and 2,700ft. above the sea. You may say, That is all very well, but how does that apply to our conditions? We often hear it said that on the higher hills in this country timber cannot be grown successfully. Of course there is some difficulty at starting, but I maintain that in these high elevations these forests produce this large quantity of timber because they were always kept under forest, the productive powers of the soil were preserved, and they were taken under systematic management in 1817 before any large demand, except a local demand, had arisen on these areas. There is not the slightest doubt that the greater portion of Britain was once under forest in former times, but the forests have disappeared, and these areas have been long exposed to climatic influences, and the greater portion now is in a condition that on starting you have some difficulty; but if you succeed in raising the first forest crop again on those areas, there is not the slightest doubt the yielding capacity of the soil will return again.

2274. (*Chairman.*) Then, in order to carry out the necessary improvements in forestry as practised in this country, would you give us your views on the development of forestry education in Britain?—The question of forestry education is a little complicated in this country. We have, in the first place, with the exception of small areas, the whole of the land in private hands, and this necessitates our exercising a considerable influence upon those persons who can finally determine whether land is to be afforested or not, that is to say the proprietors. Then we have what I should call a high class of estate agents. Again, there is a demand for good managers for smaller estates, and a demand for the actual forester. I think we must approach the thing from this point of view. We ought to provide the means of high forestry education, and for a somewhat lower education. For high education I propose, and strongly recommend, a faculty of forestry, either by itself, or in connection with agriculture, to be established at, say Edinburgh—I only give that as an instance—and either Cambridge or Oxford. I must deviate a little here. I think we ought to approach this question of the higher education from an imperial point of view. We want highly trained experts not only for this country, but to send them to the Colonies and to India. We have a special establishment for India, but forest experts are always being demanded by the Colonies. The Indian Forest Department, whenever it is possible, readily agree to supply properly trained forest experts for forest organisation in the colonies; but still it is a heavy demand. It has now come to this, that the Indian Government has had to add a certain percentage to its staff in order to be able to always have a certain number on hand whom they can lend to the Colonies. That is all very well, and we have been most happy to do that in India, but it is a state of things that neither can continue, nor ought to continue. The imperial idea is now developed to such an extent in this country that I think we ought to attack this higher forest education from an Imperial point of view. I think we ought to have a Faculty of Forestry at the University, one in Scotland and one in England, where we can give a thoroughly complete training to forest experts, gentlemen who either like to work in this country or go to the Colonies or India. I will first take the proprietors. A large proportion of the landed proprietors go to the University to take their degree, and they should be given an opportunity of becoming acquainted with forestry. They might choose to take a degree in forestry, but it is not very likely, and it does not matter very much; but they should be given an opportunity of becoming acquainted with the principles of sylviculture and forest management by either attending portions of the general course or by a special series of lectures given to the sons of landed proprietors. Both might be very well arranged for; it would also apply to some extent to the higher class of estate agents, who would go in for the degree of forestry or agriculture, or the two combined, as the case might be. In one case agriculture might be the first subject and forestry the second, and in the other case forestry might have the first place and agriculture the second. Or even if they take an ordinary degree just to prepare themseves for estates management—and there are a good many of them now-a-days—they should have an opportunity of becoming acquainted, by attending a somewhat higher course, with sound principles of forestry. For that purpose of course we require the means. In each case, both in Scotland and in England, there ought to be means found to acquire a forest estate of sufficient size to be used as a teaching forest for the schools. Until such can be done I have no doubt that preliminary arrangements might be made in some of the private estates which are thought to lend themselves to the purpose of instruction. Although a good many of these estates have not forests in such a position that they can for any length of time serve that purpose, still there are instructive patches of forest in almost every one of them. I have lately become acquainted with the forests of the Duke of Bedford, which are situated within one hour's rail of Cambridge or Oxford, where there are a good many patches of forest which could be used for instruction. Although as a whole they are not in the condition in which I should like to see them, His Grace has been good enough to ask me to make him a working plan, which I did about three years ago, and it is being gradually worked up to. A good portion of these forests can be used for practical instruction. The gentlemen who attend such lectures will also be in a position, by having the means, to go on excursions to the Continent until we have provided in this country the areas where this practical instruction can be given. As to the lower education, I will go at once to the lowest, and may then add a few remarks about the middle class. With regard to the instruction of the foresters who will take charge of the smaller areas, I am strongly of opinion that the best thing to be done is to effect this in the school forests, or instruction forests. Such an instruction forest should have a competent manager, and these men who desire to work themselves up to foresters on smaller estates would come as apprentices, would work in the forest, and receive just sufficient pay for their food and keep. The manager should be thoroughly competent to give all the practical instruction necessary, and also some elementary theoretical instruction, at any rate to guide them in reading elementary works on science connected with forestry. If you attempt anything more I think you will meet with great difficulties. Let the ordinary forester who manages small estates begin as a young apprentice, as a working man. He should have a fair school education, and then come as a youngster to be apprenticed in the school forest, and work for his living, and he would be instructed in practical work, and, as I say, the manager ought to be able to give some elementary instruction in science. I now come to the intermediate position. It may be possible to make provision at agricultural colleges, where the ordinary class of estate agents go, for a course of theoretical instruction consisting of a moderate number of lectures, accompanied by visits to school forests and suitable private estates—and I add, as an important point, distinguished apprentices trained under the lower course should be given facilities to attend such a course if they had made sufficient progress to warrant it. That is an outline of my scheme.

Professor W. Schlick,
C.I.E., F.R.S.

25 Apr. 1902.

Professor W. Schlich, C.I.E., F.R.S.

25 Apr. 1902.

2275. Probably Cambridge would be the best centre at which to give the owners some instruction?—Until Mr. Rhodes' will was published I should have said Cambridge, but now that probably so many Colonial students will be coming to Oxford I think we must not put Oxford on one side—we must consider it.

2276. But you would take one or the other?—Until Mr. Rhodes' will was published I should have said Cambridge.

2277. Supposing the Duke of Bedford were good enough to allow his area under plan to be utilised, that would be sufficient for practical demonstration purposes for Cambridge students?—Yes, to start with. On the other hand, let me point out that a good many of the woods in the Chiltern Hills are probably more easily accessible from Oxford. The Duke of Bedford's woods are only about a quarter of an hour further by rail from Oxford than they are from Cambridge.

2278. At any rate we have a definite proposition that one or other of the great English Universities would be a good centre for the instruction of the higher classes?—Yes. Probably the authorities, as the matter stands at Cambridge at present, would more readily meet any requests than Oxford; but what changes this influx of 164 scholars will make on the authorities at Oxford it is as yet impossible to say. I expect very considerable changes in Oxford.

2279. I think it very desirable to have definite views on these points which you have mentioned. Have you any views as to where the best site for the forest school or for the instruction of working foresters should be?—In the case of England I am afraid there would be a little difficulty, but I do not see why we should not enquire whether we could get an area which is at present under the management of His Majesty's Commissioners of Woods and Forests.

2280. What sized area do you think would be required? I might put it shortly: Do you agree generally with Colonel Bailey's scheme for an experimental forest area?—I agree with Colonel Bailey that it is absolutely necessary to have such a forest.

2281. And as to the size of it?—With regard to the size, of course the larger and the more varied the better. I have something else to say on that subject. I have to make another proposal, which I am a little afraid of bringing forward as the South African war is not yet finished, although I daresay it will be finished soon. I do not see why the State should not acquire certain estates in several parts of the country. Instead of having one area I should have several, and the State might consider whether it would not be worth while to acquire certain areas in various parts of the country, and every one of those might be made available for instruction.

2282. But as to the instruction for the owners, we had it quite clearly from you that Cambridge or Oxford would be a suitable centre?—Yes.

2283. Probably a beginning would be made at one centre first?—Yes; I should not advise two to start with, because it would be asking too much if you went in for more than one.

2284. What centre would you choose for the forest school or the working forest?—We are going to look at an area which Mr. Stafford Howard has drawn our attention to, and if that were found to be suitable it might possibly lead to this, that Oxford might be more suitable than Cambridge. If, on the other hand, we could get hold in some way or other of an area like Esher woods, or some others in the centre of England, under the direction of the Commissioner of Woods and Forests, possibly Cambridge might be as well suited. Whether we took Oxford or Cambridge would to some extent I think depend where we have our school forest.

2285. Then you would have your forest school for the training of foresters within reach either of Cambridge or Oxford?—I should have it so that the lecturer or professor in charge at either Oxford or Cambridge could readily go to the school forest and take his students readily there. With regard to the students at the University, the question of £ s. d. does not come in to the same extent as in the question of the lower students. Of course the nearer the better, so that you can get there in an afternoon, but I would not make that an absolute point. The railway communication is so good in England that a somewhat longer distance would not be very important The great point is to get a suitable area.

2286. The first point then is to get a suitable area?—Yes, even if it is a little farther away from the Faculty of Forestry at the University.

2287. Supposing you find the most suitable area in the North of England or in Scotland, would you begin there?—I should begin in Scotland as one centre certainly; but I think we should make a great mistake if we are going to concentrate the business in Scotland.

2288. You would carry out the Imperial policy better in connection with one of the Universities with the Forest school within reach of it?—Yes; I should prefer one in England and one in Scotland.

2289. Perhaps you will give us some information about Coopers Hill and your views regarding its suitability for the education of Indian forest officers or colonial forest officers?—May I make a suggestion? Perhaps you would prefer to ask me a question about the course at Coopers Hill, so as to give an idea of what we consider a forest expert should know.

2290. I will put my question in that form, if you will kindly give us a sketch of the course at Coopers Hill?—At Coopers Hill we only pretend to train foresters for the service of the Government of India. In that country forest management was systematised in 1864. Since that time we have constituted something like 60 million acres of land as permanent State forests, and we have some 20 million acres of other forests to manage, for which we require a large staff. We have about 200 English officials, and about 11,000 native officials, so that you see it is a large concern. We have trained the officers of the Indian Forest Department since the year 1867, first in France and Germany, subsequently in France only, and since 1885 at Coopers Hill. The importance of the business you will at once perceive from this, that while in those 40 years the condition of the forests in India have enormously improved—in fact, in some parts so much that people say it is actually beginning to affect the climate—the net revenue of the Indian forests in that time has risen to something like six times what it was in 1864. Thirty-five years ago the net revenue was 16 lakhs, now it is about 100 lakhs. This, of course, is already a considerable item of State income, and the results have been so good that the Government of India is determined to give the best possible education to the superior forest staff. In 1885 I was deputed to establish the forest branch of Coopers Hill College. It is tacked on to an engineering establishment, and only a quarter of the students are forest students, and three-quarters engineering and telegraph students, so that the importance of the engineering training is greater than that of forestry. Every year a certain number of candidateships are advertised, and the competitors go up for an examination in mathematics up to and including trigonometry, botany, chemistry and heat, English composition, geography, geometrical drawing, free-hand drawing, and German. They can select also out of a number of subjects two further subjects. The following is a list of the subjects from which they may select:—Higher mathematics, Latin, French, Greek, elementary physics, physiography and geology; but they are not allowed to take more than two. They take up those I read first, and two of the others. In fact, they are the class of men we get from our higher public schools. Those who pass the examinations in the best manner, if there is otherwise no objection to them, are sent to Coopers Hill for three years' training. We continue geometrical drawing and freehand drawing, and we teach them surveying, a little forest engineering, a little about accounts, and continue to keep up their German, giving them a couple of lessons a week. They get some elementary physics, selected chapters of organic chemistry and analysis of soils, and they have geology, entomology, botany, and forestry. As the syllabus stands, every student at Coopers Hill receives 410 lectures on forestry, and about 150 lectures on botany, 30 lectures on entomology, and 45 on forest law. The botany is accompanied by excursions and by work in the laboratory. They have to work in the laboratory 60 times, and they have about 20 excursions into the field. The forest instruction in the class room is supplemented by excursions. Altogether, in the first year there are about 20 half day excursions, and five full day excursions, these excursions being generally to forests in the vicinity of Coopers Hill. At the end of the first year there is a 15 days' excursion to Normandy to see the systematic management of

French forests. During the second year there are occasional excursions for practising timber measuring, etc., the number of which is not fixed. In the third year they go for 9½ months to Germany, and they are there placed two and two with selected, highly trained Prussian State forest officers of experience, and there they remain for 8 months, having to make themselves acquainted with all the operations in forests which have been under systematic management for not less than 80 and some for over 100 years. First of all they must make themselves acquainted with the composition of the forests, and then they are instructed in the methods of thinning young wood, middle aged, and old woods. They have to mark cuttings for natural regeneration, preliminary cuttings, seeding cuttings, and learn how they are executed. They have to become acquainted with planting and sowing. They become acquainted with the cutting of timber into profitable lengths and dimensions for sale, and become acquainted also, of course, with the diseases of trees, and damage to trees, etc. At the end of the eight months I take them for a tour of six weeks to several interesting forest districts in Germany, Switzerland, and, occasionally, into France, where special systems of management, with which they have not been previously acquainted, are practised. I remain three, four, or five days in one locality, and teach them the different methods of treatment, and let them write a report upon it, with critical remarks on all that they have seen, so that their education shall be further enlarged. At the end of three years they are considered fit to be sent to India.

2291. Can you give us any information as to the value of that course as compared with any other?—I am largely interested in the course myself; but, of course, I think it is as good as it can be made under the circumstances. At the same time I think there are certain drawbacks to it. These forest officers have to take part in the general administration of the country in India. They live among the wild tribes in out of the way places, and have a very great influence on the welfare of the people in those districts, and, therefore, many of them are vested with magisterial powers. They have a considerable influence on the general administration of the Indian Empire, and, therefore, a certain value is placed upon the fact that they are trained together with other men who go out to India, with engineers and telegraph officers; and some people think it has a very great educational effect upon them. But while recognising that as far as it goes, my own personal opinion is that the more a man during his studies, as he would do at a university, rubs up against people of other persuasions, the better for him. In my opinion at a university you come in contact with people of all kinds, not only those who go in a particular groove, which has a great educational effect. You learn to know that there are people living on the other side of the hill, whereas there is a little tendency to think that "Coopers Hill is Coopers Hill, A1." That is one point. There is another drawback. The teaching of several branches of science is arranged more particularly to meet the requirements of engineering, although we are gradually eliminating that by giving special instructions to forest students. I will give one instance. In chemistry it has been lately settled that particular importance is to be paid to the heavy metals, and all that sort of thing, for the instruction of engineering students, etc., whereas those parts of chemistry which are far more important to us, than iron and steel, are not altogether so prominently brought forward. The teaching of the auxiliary subjects is rather more from the point of view of the requirements of an engineer than a forester. If our men studied at a university they would get a more general knowledge of science. For the study of forest botany, Coopers Hill is a very good place. There are woods there which are treated arboriculturally, and for shooting purposes, and so on, and there are a great variety of trees, and it could be made a good place for the study of forestry, but that is impossible, because the areas are Royal shooting grounds.

2292. But there is no wood that is well grown in the neighbourhood, is there?—Yes, there are patches.

2293. There is only one subject on which I think we should like to have your views, and that is as to the measures which could be taken by the State to stimulate afforestation by the utilisation of existing State forests, and the utilisation of additional areas?—With regard to the existing State forests, they are practically State forests and are treated from a certain point of view, principally I think for revenue, if I am correct. Mr. Stafford Howard is the gentleman who has taken an enlightened view of the matter, and is endeavouring to introduce a systematic management of the forests under his charge. Working plans have now been made for the Forest of Dean, for the High Meadow Woods, and I think it is the intention of the Commissioner of Woods to do that wherever it is practicable, where he does not consider that other considerations are of greater importance, or where excessive rights prevent this being done. I think a little more might be done in the New Forest, although the difficulties are very great. As far as I understand the present law there is a certain area which may be enclosed and kept under forest in the New Forest. I think the Commissioner of Woods ought to face the outcry which would be probably raised if these 12,000 or 14,000 acres were put under a systematic management. I think the State might in other places acquire forests as the opportunity offers. I am not exactly prepared to say where at the present moment, because it would be the subject of a special enquiry, but I think the State might acquire some areas in Scotland which might be made available as School Forests; possibly opportunity may offer in England too. Of course if it was in Ireland I should say much more, but that does not come within our enquiry.

2294. You believe the creation of a system of efficiently managed State forests would be a good thing for the country?—Yes.

2295. One other subject. Do you think that something might be done to stimulate private effort by providing the means of forestry education and giving advice through experts, and perhaps also by advances for planting?—That goes to a great extent with what I have said as regards education. I think the State ought to assist to provide the higher education, at any rate at universities, and also give assistance for instructing and educating foresters. At the same time I do not see why the landed proprietors themselves should not step in and give help. It is in their interests, and I do not see why it should not be possible to form associations of proprietors, as has been done in other parts of the world, and get them to assist in this matter. I am perfectly certain that if the matter was put before them in a proper way a great many landed proprietors would assist in having centres of instruction. With regard to financial assistance for the purpose of extended afforestation, I have been met repeatedly, when I have suggested that, with, "Oh, it is all very well, but where is the money to come from?" I do not see why somewhat more extended means should not be made available for taking up money to be paid in the shape of a sinking fund. It might be arranged that interest is paid on the actual loan for a number of years until the returns begin to come in, and then the loan should be paid off rapidly in the course of ten or fifteen years. I have had conversations with various landed proprietors who would be only too ready to fall in with a system like that, and take advantage of it.

2296. And you think perhaps some advice might be given through experts?—I think if the State could have a sort of Inspector or expert attached, say, to the Agricultural Department or to the Commissioners of Woods and Forests, a man who was always available to give advice from time to time, or to go and inspect woods when advances had to be made, it would be very highly advisable. Of course we have Dr. Somerville, but I think Dr. Somerville has a good deal of other work to do as well. I think it would be quite worth while to have, at any rate to begin with, one forest expert attached to the Agricultural Department, or, if the management of the business was made over to the Commissioners of Woods, then to their Department. I have already stated that a good beginning has been made in some of the Crown forests to bring the forests under systematic management. The Commissioners of Woods and Forests have comparatively little to do with woods, and a great deal with ground mining rights, etc.; but I think the Commissioners of Woods might take into consideration that there should be, at any rate one local assistant fully trained in forestry at each centre of operations, such as the Forest of Dean, and the New Forest. Mr. Stafford Howard has appointed one assistant to the Forest of Dean, but I think another one at the New Forest would be very useful. It should be a recognised thing that one

Professor W. Schlich, C.I.E., F.R.S.

25 Apr. 1902.

Professor W. Schlich,
C.I.E., F.R.S.

25 Apr. 1902.

of the assistants should be a thoroughly well-trained forester.

2297. I think that everybody who is interested in forestry would agree with that?—I think Mr. Stafford Howard himself will do that.

2298. (*Mr. Stafford Howard.*) A good deal of work has been already done?—It has been done already in one place, but I should like to see the principle recognised, because you may not control the Department much longer, and your successor may hold different views.

2299. You have given us certain areas which you say are or might be available for planting, some of them not recognised in any way as being used for agriculture, and others which are used for grazing. With regard to those not used for any agricultural purposes, I should think they would be probably the most inaccessible?—Probably so.

2300. In mountainous districts?—Probably there are also a great many which are bog, peat, etc.

2301. Therefore it is probable that a good deal of it would not be suitable for planting?—Probably, only a certain proportion would be suitable.

2302. And it might be difficult to find any large area in one place suitable for planting?—What do you call a "large area"?

2303. A thousand acres?—Do you mean in one spot?

2304. Practically in one district?—Of course that might be, but if blocks of some 500 acres and upwards were available, it would be sufficient for economic working.

2305. You were suggesting that the State should acquire land for the purpose of planting. It would not be worth while the State acquiring a little plot here and a little plot there?—I should have a limit. I do not think that operations on small areas would ever be financially productive. In my publications I have generally spoken of 500 acres and upwards.

2306. If these places are very inaccessible you would require to make the access better and spend a great deal of money, and it would not be worth while doing that unless you had a sufficient area to do it with?—That is no doubt true; if they were scattered it would involve extra expense.

2307. And would it be less likely to be profitable?—It would be less likely to be profitable.

2308. With regard to the other area used for grazing, you instance a fact that some large towns have acquired considerable areas and have got rid of the rights of grazing, and I think you drew the inference from that that the State might possibly do the same thing. But these areas are required for the purpose of supplying these towns with water, and the whole expense is borne by the rates in these towns. They do not take into consideration the question whether it will pay. It is absolutely necessary for them to have it. While it might be possible for these people, having this area, and having got rid of the grazing, or what rights of the people there are on that area, it would be quite a different thing for the State to get rid of people by Act of Parliament for the purpose of planting?—I have limited my proposal with regard to the State action within reasonable bounds. Where the difficulties are very great I would not attempt it. There are areas found here and there over the country where the difficulties are surmountable. In all my writings I have made that a point. I would not disturb any agricultural operations. Where any heavy pressure has to be brought upon the surrounding population it would be probably advisable, at the present time at any rate, not to attempt anything. There must, however, be many areas where the difficulties are so small that they can be overcome.

2309. I do not think in my experience in those districts which are subject to grazing rights, which I am speaking of now, the difficulties are so slight in any of them?—You are thinking of Wales, I think.

2310. I think you will find the difficulty is pretty much the same everywhere. I know a good deal of the Northern Counties as well as Wales, and the same thing would apply to both. My opinion is that the limit you put upon it is so much as to practically exclude the greater part of the millions of acres of which you have spoken?—Of all those areas probably a couple of millions would be situated in Ireland, and certainly another couple of millions would be situated in Scotland, and here in England I would restrict the operations of the State in the first instance to a few areas required for instructional purposes, and I would in England rely more on the landed proprietor.

2311. It is quite possible where one large area may be in the hands of one owner that you may make an arrangement there by voluntary agreement or by purchase, but where you have a number of owners concerned, as is the case in these large areas, I think the difficulties would be very great indeed?—I think you over-estimate a little what I say about the acquisition by the State in England. I should be very cautious with regard to the acquisition of areas by the State in England.

2312. That is what I wanted you to say?—I think it is worth while, if the areas now at its disposal are not suitable for instructional purposes, for the State to acquire a few areas which could be made available for instruction.

2313. In different places?—In suitable places where they are required for the purpose. As far as England is concerned, my proposal for State action is very limited.

2314. You have given us your idea of what forestry instruction should be, and you lay great importance, with regard to the instruction of owners and the higher class of land agents, on the fact that if possible it should be in connection with one of the Universities. You also lay great stress on the necessity of practical demonstration, and therefore you would like to see an instruction forest, as the Chairman has called it, of sufficient area, within reasonable distance of one or other of those Universities, if it can be so arranged?—Yes. I have said, with regard to University students, that the question of the distance is not of the same importance as in the case of the instruction of men of limited means. Whether you go an hour by rail or two hours by rail, after all, the distance would not be insurmountable, and excursions could be arranged to extend over several days at a time. I should like to have it as near as possible to the University, but if it is not obtainable within an hour of the University I do not object to two hours.

2315. What you would like to see is an instruction forest of sufficient area, and showing sufficient variety, large enough to employ a certain number of practical foresters who would be anxious to learn for estate purposes on various estates in the country, and at the same time such estates would be available for the higher class of students coming from the Universities?—It would answer both purposes.

2316. Who do you propose should manage the area?—You must have a competent manager, of course, otherwise you fail to begin with.

2317. Is it to be in connection with the University—would the University appoint someone?—That, of course, would be a question for inquiry, and that is where I want the State to come in in England. If two, three, or four estates, either belonging to the State already or having been acquired by the State, could be made available for instruction, I should expect that a competent forester would be put in charge of those estates. We might commence by a retired Indian forest officer. As you know, we have a number of men who retire at the age of 45 years and onward, with a pension of £450 or £500, and if you offered these men an additional appointment of £300, they would be most happy to take it.

2318. It would be used really and truly as an instruction forest, and not necessarily for the purpose of making profits?—I should at once begin to put it in a way that it would give the highest possible profit derivable from the area—most decidedly.

2319. You would combine the two?—Yes, you can combine the two. They are combined everywhere on the Continent.

2320. But it is very desirable, supposing this establishment at Oxford or Cambridge, that those who give instruction to the students should be in touch with the man on the spot, the manager?—Yes. It might be so managed that the whole of the management could be controlled by the Professor at the University. Let me give you an instance. Last week I was at one of the principal German forest schools, and there the director of the forest school is also the officer who controls the management of two ranges, each comprising about 5,000 hectares. They are managed for profit, but at the same time they lend themselves to the purposes of instruction.

2321. I do not propose to go into the vexed question

Professor W. Schlich, C.I.E., F.R.S.

25 Apr. 1902.

of the New Forest, but I should like to make this observation, because the Chairman asked a question of Mr. Forbes the other day from which I gathered that he thought Mr. Lascelles had described the New Forest in some former evidence as being 40,000 acres of waste land. He has kindly referred me to the passage, and I see Mr. Lascelles, in making that observation, was referring to the 40,000 acres of open land which was subject to grazing right. It is commonly called in the New Forest "the waste of the forest." I wish to make that explanation because it was not quite a correct reference to what Mr. Lascelles said, I think, and possibly the Chairman may wish me to correct it?—I have put the area of forest there over which you have control at 12,000 or 14,000 acres.

2322. But the whole area of the forest is 63,000 acres, and we have the power of enclosing 16,000 within an area of something over 17,000. We can only deal with 17,000 acres, and of that we can keep 16,000 enclosed?—I see.

2323. (*Professor Campbell.*) I wish to put one or two questions in order to make certain points clear. We have had several statements with regard to the income from woods in England. Am I right in saying that you stated that in the majority of cases you think the returns are under-stated?—I did not mean to say that. What I mean to say is, that the majority of the woods are not made to yield that quantity of timber which they are capable of yielding. If you manage a forest so as to get 30 cubic feet a year out of it, and it could be managed so as to get 50 cubic feet out of it, it is not fair to say that the forest will not pay, as you do not manage your forest to get the largest quantity of timber out of it.

2324. I think you stated that the figures were not reliable?—There are so many things charged against these forests. I mentioned roads, rides, and fences, which practically have nothing to do with it.

2325. That led me to assume that you thought these figures were usually under-stated, and that the woods would yield more?—No. The figures represent things from which you cannot draw a conclusion as to the financial results. That is what I meant.

2326. You also said that you did not recommend the use of agricultural land for woods. I suppose by agricultural land you mean land that is under crops—tillage land?—Tillage land and the real grazing land. If a person came forward who was the proprietor of a farm, and said "Will you buy my farm and put it under forest?" I should accept it, of course, but I do not count on that. I do not want to take a single acre of land out of cultivation.

2327. But that was what you had in your mind when you used the word "agricultural"?—Yes.

2328. We have had some evidence with regard to the upper and lower limits of altitude between which you can plant. You did not touch upon that in your evidence?—I gave you my opinion about it. I have occasionally put forward certain figures, but they only refer to certain conditions. It is absolutely impossible to say here in this room what is the uttermost limit, as it depends on the agricultural conditions, the nature of the land, what it can produce, etc. I think one may get into a very false position by making any statement in a general sort of way.

2329. So that the figures we had from previous witnesses should be only taken as applicable to the land that they were speaking of, and not generally?—They may be applicable to certain cases, but you could not build any theory upon them—or at least, I do not think so. May I illustrate my point? I put forward a case in my book; I said: "It is profitable to put land under forest which is capable of producing a ton and a half per acre of coniferous timber in the year on an average situated within 100 miles of a mining district, provided the rent is not more than 11s." You cannot make a general statement. I only want to guard against being misunderstood.

2330. I suppose that if the State is to plant forests it is very important to consider the position with regard to railways and canals, and so on?—No doubt. It depends to a great extent on the area which you have in one locality. For instance, in the wilds of Ireland there was an estate, when I was in County Galway some years ago, of 20,000 acres, which the Congested Districts Board could buy for 10s. an acre. If the Congested Districts Board had accepted that, and planted the greater proportion of that area, it would have required by and by a small branch line to connect it with the County Galway Central Railway. These are all things which depend entirely on the local conditions, and you cannot make general statements.

2331. Did I understand you to advocate State forests in this country (quite apart from a forest to be used as a school) in the interests purely of the production of timber?—As matters stand, there are absolutely insurmountable difficulties in having anything like a large proportion of State forests in this country. Therefore what I hope is, that by giving the means to landed proprietors and the better class of land agents to become acquainted with the principles of forestry, the landed proprietors themselves will extend their operations. There was a proposal publicly expressed, two years ago, that Parliament ought to devote for the next 100 years a million pounds a year for the purpose of purchasing land to make six million acres of State forest, but that, of course, is utopian. We want the proprietors of the land to learn that the thing can be done economically, and that it will pay in the long run. That does not refer to Ireland.

2332. Of course, this inquiry does not extend to Ireland, but in view of the efforts made by the State there I think it would perhaps be well if we had your views with regard to the cause of any failure that has attended the operations of the Congested Districts Board. Such failures may be put forward as an argument against the State entertaining further schemes for planting waste land?—As our time is short, may I suggest that I submit this pamphlet? It is all written down here, and some portions may be suitable to go into the Appendix.

2333. (*Chairman.*) I think it will be very desirable to have either that pamphlet or the essential parts of it printed?—If you will spend any time upon it now, I am ready to answer any questions.

2333*. (*Professor Campbell.*) You could perhaps briefly tell us the cause of the failures in Ireland?

(*Chairman.*) It is a little outside our Reference, perhaps.

(*Witness.*) Yes, but I might give it shortly. I presume you refer to Knockboy? Knockboy is situated on the west coast of County Galway, directly facing the sea, exposed to strong gales, and especially to the salt spray carried inland by these strong gales. The failure there is due partly to the salt spray carried inland. I may mention that in the month of July, when I was there, a gale sprang up, and during the night the effect of the salt spray was such that all the needles of the pines next morning had red edges round them. That occurred over and over again. Then, of course, there are heavy westerly gales to which the district is exposed, and the excessively boggy nature of the soil. What I said was this, that if they had gone just on the other side of that hill, and had taken an estate of 500 acres, so that one hill range would have intervened between the strong westerly gales and the salt spray and the plantations, they would probably have been successful. I also took a great deal of trouble to clear up the matter of the bog question. I took a special journey at my own expense to North Germany, and examined plantations on boggy ground, and I found that you could not plant successfully in boggy ground if the depth of the bog was more than 1½ yards unless you let the land lie for a series of years after draining. I found there a bog 25 ft. in depth, and I found spruce wood 54 ft. high 42 years old, mean diameter about 12 in. at 4 ft. from the ground. I found oaks 45 ft. high at the same age, with a diameter of about 16 in. But that was boggy land which had been drained many years ago, before it was planted, and had settled down. On the other hand, where fresh bog was taken in hand in another place, I found that you could at once spot the places where the bog was deeper than a yard. You had only to look at the trees, and you found the depth was 4 to 6 ft. Up to the depth of a yard bog does not interfere if properly treated.

2334. (*Professor Campbell.*) The point I want to get at is this, that the results obtained in Ireland should not in any way be taken as evidence against State forests in England, the failure being entirely due to unfavourable circumstances?—No, certainly not.

2334*. It will be so stated?—Certainly it should not be.

2335. It will be advanced as an argument against using State money for growing timber, but you would

Professor W. Schlich, C.I.E., F.R.S.

25 Apr. 1902.

not for a moment let such failures weigh with you?—No. I told the Congested Districts Board that it was a blunder to begin in that place, and that they should have taken good advice before starting. They started it, and when the thing went wrong they came and said, "Will you come and tell us what to do?" I told them to take good advice before it was done, but they knew all about it, and one of the Land Commissioners went for a fortnight to Austria, and came back, brimful of knowledge, and started the thing. When they had worked at it for three or four years, and it went all wrong, they asked me to come and look at it, and I said, "You would have done better if you had asked me to come when you first started."

2336. In fact, the failure at Knockboy is the very best evidence we have of the need of trained experts in this country?—Very much so, indeed.

2336.* There is one point about the German woods upon which I should like to have your opinion. We have heard a great deal about game; does game affect the woods there?—Until quite lately rabbits have been very rare in most of the Continental forests, but they are coming in more. But we have another thing on the Continent that is dreadful, and that is the red deer. In some of the woods of which I have given you the financial results, I have seen woods where every tree was barked by red deer. Quite lately there has been a law published in Prussia that red deer are to be kept within certain limits, and above all that there must be a proper proportion between the sexes. The most damage is done really by the old hinds.

2337. Then it has also been urged by one witness that the land there is very regular, and lends itself to a system of regular cultivation, and that in this country the same results could not be obtained. I suppose this simply means that in Germany you can have your areas nicely laid off in parallel strips. In this country you could have the same thing, only perhaps not quite so regularly laid out? Is it the case that in this country the land is not uniform enough to demonstrate the Continental system?—This is not the case as far as I am acquainted with Germany.

2338. It was stated that the land in Germany or in these Continental forests was much more uniform?—I have given you an example of 4,000 acres which lie between 1,500 and 2,700 feet above the sea, on steep slopes.

2339. Are these slopes uniform?—I do not quite follow you.

2340. There may be a uniform decrease in the depth of the soil, for example, as you go up?—There is no great difference between the soil in this country and the soil in the Continental countries. You can find all sorts of conditions here as well as there.

2341. But you would not say that the land in England is as uniform as the land in Germany You can get a stretch of uniform land there which you cannot get here?—You do not get uniform stretches of land on the Continent. I have never seen them, unless in land where there was a stretch of sand dunes or anything of that sort. All German forests are practically classified in five different quality classes. Some of them produce perhaps 10 cubic feet per annum, and others produce 150 cubic feet per annum.

2342. You have large tracts of land in Germany on the same geological formation, have not you?—Not more so than in this country.

2343. But very much larger than in this country?—I do not think so, not as far as forestry is concerned.

2344. And the contours of the hills there are not more regular than here?—Probably in the hilly parts it is steeper than it is here. If you go to the Jura Mountains you will find some very steep hills.

2345. You are of opinion that there has been a considerable increase of interest in forestry during recent years?—There is a certain amount of increase, no doubt.

2346. And if we could by any means increase that interest you think it would go a long way towards causing landlords to plant?—That is one of the most important points, to stimulate interest in extended afforestation.

2347. And you think we want more literature, more conferences, more discussions, more schools, and more education generally?—Yes, as a general proposition.

2348. Have you made out any estimate of the cost of a Forest School?—No, I have not at present. I had one in a previous case, but that was under different conditions.

2349. But that could be done?—Yes, very easily.

2350. Would you have classrooms attached to this Forest School?—Which Forest School?

2351. If we start one in this country?—I have suggested three different kinds of Forest Schools. You want an establishment at the University; you want an instruction room at your Model Forest, but it would not be very expensive; and at the Agricultural Colleges you would probably have classrooms enough to give a limited number of lectures.

2352. One or two simple classrooms would be required at the forest?—Yes, according to the establishment to which it is tacked on.

2353. (*Mr. J. H. Lewis.*) In advocating higher instruction in forestry you suggested Oxford or Cambridge as the centre for England, and you suggested that recent benefactions have brought the Colonies into closer touch with Oxford, and that that might be a reason for going to Oxford. Would not you say there are a larger number of landowners who go to Oxford, and that that might be an additional reason for selecting Oxford as a centre?—I have not made any choice between the two. Probably, as there is an Agricultural Department at Cambridge, the difficulties would be less in Cambridge to start with, but I believe a very large proportion of the sons of proprietors come to Oxford, and now there will be at any rate some 65 Colonials studying at Oxford.

2354. You think it is important that the sons of landed proprietors should be brought into touch with forestry education?—Very important indeed.

2355. Do you think it would be desirable to utilise for the purpose of forestry instruction, University Colleges in different parts of the country, particularly those which have agricultural departments attached to them?—That was part of my proposal, and I have already dealt with that.

2356. With regard to the very interesting evidence that you gave as to the growth of revenue from forests in India bearing out the figures that the Secretary of State for India gave me a few weeks ago, when you say that the revenue has been multiplied by 6——?—I spoke from memory, and I should like to look up the actual figures.

2357. It has been very largely increased and multiplied several times during a comparatively short period of years. You are quite sure that there has been no over-cutting of the forests, or any exceptional treatment of that kind?—I am perfectly sure that the forests are worth more now than they were 40 years ago.

2358. That is what I wanted to get out. With regard to your suggestions as to State forests in this country, I think you said that, apart from 12,000,000 acres of land on which there were grazing rights, there were 9,000,000 acres of waste land which were not subject to such rights at all?—I did not say they were not subject to rights.

2359. I think so?—No. I said they were not accounted for in the agricultural returns except under the heading of waste lands.

2360. Is it your impression, as the result of inquiries that you have made, and from what you have seen in different parts of the country, looking at the country with the eye of an expert in forestry, that there are waste lands in this country which might be profitably afforested?—I am sure there are.

2361. And could be afforested by the State?—Yes. State action would be very difficult, I think, in England from what it would be, for instance, in Scotland; but I believe there are considerable areas, though how much only a special local inquiry could ascertain.

2362. A witness who gave evidence before a previous inquiry stated that Wales contained a larger amount of waste land proportionately suitable for planting than any other parts of the country. Would you be disposed to assent to or dissent from that proposition?—I could not say offhand. I do not think it is so as compared with Scotland or Ireland. Scotland, I should say, has more, and I could easily supply information on that matter hereafter. I could not say offhand.

2363. Assuming that it were possible for the State to undertake the afforesting of suitable areas in the country after very careful inquiry and examination as to their suitability, do you consider that the unity of control,

Professor W. Schlich,
C.I.E., F.R.S.

25 Apr. 1902.

proper and scientific management of those areas, the possibility of obtaining accurate returns and statistics as to the cost of planting and management, and as to the yield and so forth—do you consider that would be a great advantage to have on an extensive scale?—Yes; but it is rather a large budget you have given me to answer all at once. You mean to say the collection of statistical data?

2364. Let me begin at the beginning. Assuming that it would be found possible by the State to afforest suitable areas of waste land in this country, after careful examination as to situation, accessibility, and general convenience and so forth, assuming that a certain number of areas of that kind could be found, would you consider that it would be an advantage to forestry as a whole that there should be large areas or different areas under one system of scientific management in order that actual facts and data and statistics could be obtained for the information of the country generally, as they are now obtained in Continental countries?—The State forests which are likely to be established should certainly be used to the utmost extent for the collection of statistics and to serve as model forests showing the treatment of forests under different circumstances. That would be certainly a very important point; in fact, they would be chiefly useful in that respect, apart from opportunities for education.

2365. Is it your opinion that expenditure wisely made upon State forests would be likely to be reproductive in this country?—Expenditure wisely made as you say would no doubt be remunerative, or it would not be wisely invested.

2366. Do you think that such expenditure could be wisely made?—I think it could be.

2367. It could be wisely made in that direction?—Yes; perhaps I may add that I want principally the landed proprietor to go in for the business. I only want to acquire State forests so far as it is necessary either to serve as training grounds or as localities where you can collect statistics, or in some cases, as in Ireland, provide additional labour for the people. Beyond that I do not go with regard to the State.

2368. Do you think it would be possible for the State to set a good example in that respect?—Of course I want the State to set a good example in that respect.

2369. But you do not think that very large expenditure, such as has been suggested outside Parliament—I have never heard it suggested in Parliament—very large expenditure for the next 100 years would be practicable at the present time?—I have already characterised it as utopian. If you want me to go a little further I will say ridiculous. I only want the aid of the State so far as it is absolutely necessary.

2370. (*Colonel Bailey.*) I have very few questions to ask. You have said that in your opinion, with regard to the existing woods and forests of this country the most is not made of the ground, that the crops are not what they might be?—That is quite true in a large percentage of cases.

2371. Speaking generally, although there are plots here and there producing rightly, most of them are not?—Yes.

2372. This is due probably, you will admit, to several causes, first of all to sylvicultural errors?—And errors of management.

2373. Also to want of knowledge on the part of those who are immediately in charge with regard to methods for protection, for instance?—That is met by errors of management. Shall I illustrate what I mean? I have seen a wood in Scotland where an enormous quantity of timber had been thrown down by wind; but when I looked at it I found that the gentleman in charge of the forest had opened it out by cutting on the west, and when the next gale came it threw down the rest.

2374. I wanted to split the bad management into one or two items—one of them being the want of knowledge of forest protection with regard to abating the attacks of wind. Also the want of organisation in other ways. I mean such an organisation as you would make under a working plan. There is no such thing existing, and consequently the working is not done economically?—It is not done economically.

2375. Is it not a fact also that the scattered nature of the woods, in strips and small plots of awkward shape, involving immensely long fences militates very greatly against the profits?—Yes, and as regards the fencing particularly.

2376. And also with regard to utilisation, because is it not the practice that, owing to want of organisation in the felling, the proprietors cut a few trees here and a few trees there, sending many miles to fetch a little wood, a course which must largely take away from the profits which would otherwise be derived?—Yes, precisely.

2377. It is impossible under these circumstances of scattered work to make use of mechanical means of transport and such like, which might otherwise be used?—Yes, the effects of the construction of good roads are generally under-estimated. I had a case before me a few years ago where the construction of a road costing £120 would have brought about an increase in the timber of 3d. per cubic foot. It would have produced a profit of hundreds of pounds, but the road was not made.

2378. People are apt only to judge of the future of growing forests by what they see, and it is roundly stated, as you are aware, in print and orally, that there is something wrong with the soil and climate of our country which renders it less suitable for the growing of good wood than the soil and climate of Germany, France, and other Continental countries. Do you believe in that?—Certainly I do not. A great deal of the soil, as I have already pointed out, has deteriorated in consequence of too long exposure to all the injurious influences, but *à priori* I certainly do not believe in it.

2379. You do not agree with the witness who yesterday said that the land was capable of producing one crop, but that after that it was no use restocking the ground?—Those woods, of which I have given an example, have been under spruce, say, for a thousand years, and probably before; they go on cutting down their spruce and replanting it again. You will hear it stated here that when land has had a crop of Scotch pines or spruce upon it it is no use replanting with the same species, but on inquiry you will probably find that the young plants are destroyed by insects. In Saxony they catch the insects. They put pieces of wood into the ground and the insects all collect in these pieces of wood, and then they burn them, and get rid of them.

2380. Do you think it is a fair argument to use in justification of that view that natural forests, say in Central Africa, India, or any other place, do not produce merely a single crop, but that they go on for ever?—They have gone on actually from time immemorial.

2381. You have laid great stress on the importance of stimulating the interest of the landowners in order that they may take action. You have also stated that if comparatively small State areas were provided this would perhaps have some effect in stimulating their interest and showing them what the land might be made to produce. Do you not think that is perhaps the only way of getting at them, or at any rate the most important way?—That is part of my general proposal. You must have the instruction which will catch the landed proprietor, and you must have the forest to illustrate it.

2382. But do not you think it would have a great influence on the general opinion among landowners if, apart from their putting themselves under instruction, there were at least a few areas in the country where a properly managed wood could be seen if they chose to look at it?—It is absolutely essential. If you restrict yourself simply to a chair at Cambridge or Oxford you are just building in the air.

2383. It is probable that the State areas we have been talking about would have a very great effect in exciting the interest of landlords and inducing them to move?—It is absolutely essential to have them.

2384. In answer to an objection which might be raised that it would take many many years before anything could be shown, what would you say? Do not you think that even from the early times of managing an area already wooded, matters of great interest could be shown to landed proprietors?—Yes.

2385. In buying an estate with 500 acres of wood already upon it, you have not to wait for a whole generation of trees before you can show anything?—You can show something within a very short time. I will take the Duke of Bedford's lands, where I can show you the system of natural regeneration of Scotch pines by adjoining woods which was only introduced a few years ago.

Professor W. Schlich, C.I.E., F.R.S.

25 Apr. 1902.

2386. Almost at once they begin to be very useful as practical teaching grounds, and also very interesting as object lessons?—Yes, precisely.

2387. We have heard that some County Councils have organised short courses of lectures. Do you think those are of very great use, and that they are likely to form an important agency in instruction?—No doubt they would be very useful in awakening interest in the study of forestry.

2388. You would agree with me in thinking that no teaching of a really useful practical kind can be given in that way?—It is too short, but you can awake interest.

2389. That is my own view, certainly. You have said that you attach very great importance to the fact, that any State area which may be acquired would be useful, first of all, for education and as an object lesson to proprietors, and, secondly, that on such an area as that you could carry out researches and collect data. Do you think that the collection of data and the carrying out of researches can be possibly done on any ordinary estate?—I doubt it very much. I think I have asked some questions leading to the same point before. There is the uncertainty of the ownership. You can use them, but you must take the chance of their becoming useless as time goes on.

2390. We are agreed on the great advantage of these researches and the collection of local data which we could use for teaching purposes, and in your opinion we can only really get those data with certainty from areas in which the management is continuous, as it would be in a State forest alone?—Yes, or a Corporation forest.

2391. Exactly; I accept that. That in itself forms a most important reason why the State should acquire some forests?—Certainly, that is an additional reason.

2392. Supposing there were to be an extension of the forest area; supposing some of the 4,000,000 acres of waste land in Scotland were to be afforested; it is commonly said that would lead to a very awkward result: for one thing the beauty of the country would be destroyed, because formally grown woods are very ugly. Do you think that is a serious objection?—Personally, I do not. I believe I am in very good company, as I think Lord Selborne did not consider so. I believe that artistic beauty can be very well combined with economical management.

2393. That is the way I would rather have put it—that is what I mean. Do not you think if there were to be an extension of the wooded area, in Scotland, for example, although it would doubtless apply to every other country, this extension would be very valuable, not merely for producing timber, but also as a shelter?—Certainly.

2394. It would have a very important effect on agricultural crops, stock, etc.?—Yes, I believe so.

2395. Do not you think the labour question is very important, too?—Very important. With regard to the labour question, I find that in the Saxony State forests the labour required comes to about 8s. an acre a year—about three or four days' work.

2396. Has it ever struck you in connection with the salaries now usually paid to head foresters that the proprietors are paying very little, considering the very large capital locked up in their forests?—Yes.

2397. Do you not think that if some of them could be got to realise the value that their woods actually have, or their potential value, they would find it well worth while to raise the salary of their head foresters?—I most thoroughly believe that. Let me illustrate that. Taking that district I have spoken of, of 4,000 acres, for which I have given you the data, it has been for the last 60 or 70 years managed by an officer who had nothing to do but to administer the 4,000 acres. He has gone through a course of study extending over certainly not less than five or six years, theoretical and practical study, before he was declared fit to take charge of a range like that.

2398. In the case of the small estates owners cannot perhaps afford to pay more, but if upon the larger estates employment was offered to men more highly trained in modern sylviculture and management, this would lead to a great increase in the net receipts. Say a man has 20,000 acres of wood, and there are estates in Scotland that have much more than that, and that they are worth £50 an acre, that amounts to £1,000,000. Do not you think it would pay well to put in a highly skilled, trained man with a salary of £1,000 a year, for instance?—I should certainly have more than one skilled man on an area like that. I should probably have about three or four.

2399. Each getting large salaries?—Yes. And each can attend to the details of the management in the different parts of the woods; not leave it to a wood-cutter to carry out an important operation like thinning or anything of that sort, whereby he may easily reduce the future return to one-half.

2400. Does not it seem almost absurd to have a property worth that money, or potentially worth that money, managed by a man getting 30s. or even £1 a week?—Yes.

2401. You know as a fact that such rates are paid?—Yes.

2402. You said that in the case of the school forests you would have the general lines of the management controlled by the professor at the University. Is it not the universal system in all Continental forest schools to have an area attached to the school for purposes of instruction and managed under the control of the director of the school?—It is not universal, but it is so in the majority of cases. Where it is not the case, the chair of forestry and the forests which are used are under the same authority.

2403. Is it not very difficult for a professor at a college or university to take classes for practical instruction to an area with which he has nothing to do, owing to the friction which might ensue?—There would be in this country, because nearly all the forests are private property. On the Continent the question does not arise, because a very large proportion of the forests belong to the State, and as the State also has the University, it orders the local officers to give all possible assistance.

2404. I will give you particulars. Supposing you had a State forest attached in some way to a class in Edinburgh. Would you not think that, even though that area belonged to the State, certain difficulties might arise if the director of the arrangements at the University had not something to say with regard to the control of the forest?—He must have the general control. It might be easily arranged if he is answerable to the Government.

2405. You said just now, in answer to Mr. Lewis, I think, that the State area would be certainly managed for profit. Would not you go a step further and say that if it is was not managed for profit it could not form an educational area?—Precisely.

2406. You would have lectures given to the men who were under instruction, the apprentices?—Yes.

2407. No doubt they would have to be housed on the ground?—Like labourers.

2408. And you would have some very modest provision in the way of lecture-rooms and some collections and objects to show in illustration of the lectures?—Yes, quite elementary.

2409. But there would be no very great expenditure incurred in fitting up such an establishment as that?—I should not think so. I wish to qualify that in one way. Those who really make sufficient progress may afterwards be given facilities to prosecute their studies at an agricultural college, or wherever they took the scholarships which Dr. Somerville spoke about the other day.

2410. I think the question was asked you as to what extent of ground you would take. I rather think you said you would limit it to the charge of one man, mentioning 500 acres?—No, that was with regard to the formation of State forests generally. I think 500 acres is not nearly enough.

2411. I want you to say what you think?—That is one of those questions which are difficult to answer, but I think there should be an area of a couple of thousand acres. The more the better. If you can buy an estate, the bigger it is the better, so that you would get sufficient variety.

2412. (*Sir John Rolleston.*) I am one of those who have been all their life endeavouring to persuade people to plant timber, with very indifferent success. We have heard a good deal of evidence on what was called waste land, 1,500 or 2,000 feet above the sea level, unenclosed land. Twenty years ago there was an enormous amount of land thrown up by the occupiers of this country, strong plough land, and land of that character which has run down to poor pasture, and as they say in our part of the world "will not keep a goose to the acre" now.

Would it not have been better to plant that land than let it lie idle or run down to bad pasture?—I am perfectly certain it would.

2413. I am glad to have the justification of so high an authority?—I am certain that it would.

2414. These waste lands were fenced already, were on main lines of railway, and in the very heart of England, where the timber could be got away easily, and it would have been very much better financially to-day if they had been planted?—Of course you must understand that this is only quite in a general way, because I think these lands have probably deteriorated in quality ever since.

2415. Would not you call land that is fenced and drained and has roads through it and which only lets at 2s. 6d. an acre a failure as land?—Land which was under cultivation?

2416. Yes?—I should think you would probably have got three or four times the revenue out of it by putting it under forests.

2417. It is much better economically to grow timber of that sort on land than to endeavour to grow food upon it?—I do not want to take a single acre out of land which provides food for the people, unless it is voluntarily thrown up.

2418. But the people do not want the food; they will not buy it?—If they throw it up let us take it by all means.

2419. People will not buy the food when you do produce it; they buy it from Chicago and places like that. Is it not better to encourage the growth of timber economically which will give employment to people than to encourage the growth of food?—You are touching a question now which is a very large one, and on which I hold some views. Are you sure that the corn from Chicago will come for ever? Are you aware that enormous areas of the United States of America from which we get such enormous quantities of produce were to a very large extent virgin lands, where comparatively little expenditure has had to be incurred to produce the crop? Are you also aware that the virgin land, at any rate in more accessible places, is getting less, and in many parts of the United States they have now to begin to spend as much labour and manure on their land as we do in this country? Are you aware that the time may come when the United States of America may not be able to send us grain in the same way they have sent it to us till now? Are you not aware that the price of grain and bread in this country may, and probably will, rise again, and that land will also rise in value again?

2420. Mr. Cecil Rhodes said that the land of this country can feed 6,000,000 people. We have more than 6,000,000 people, and therefore we must look to get that supply from somewhere else?—I am afraid I am not prepared on the spur of the moment to contradict the late Mr. Rhodes, but I hold a very strong opinion about this cheap grain. I think the time will come when the grain will rise again proportional to other articles of necessity.

2421. But the supply of timber is decreasing, I think you said?—I have given evidence of that already. I believe there will be a greater and greater difficulty in getting the necessary timber.

2422. And which could not be made good in less than half a century?—If once a deficiency has set in it will take a long period to make it good.

2423. Therefore it is better that the poor land of this country should grow something for which the demand is increasing rather than an article for which there is hardly any demand at all?—All the less valuable land would probably give a better return if put under timber in this country.

2424. And therefore the landowner in planting this poor land of his may look to be planting a crop of which the value will increase?—I have no doubt about it, if the operations are carried out economically. That is the great point—the operations should be carried out economically, with no fancy prices for work and management.

2425. In that connection, in speaking about the education of the landowners, agents, and foresters, it seems to me that what landowners require, what is wanted, is a consulting forester. Supposing a landowner desires to plant 200 or 500 acres, the man he would want is the man who could superintend that planting from beginning to end?—Yes.

Professor W
Schlich,
C.I.E., F.R.S.

25 Apr. 1902

2426. We want that class of man, the consulting forester; we do not want to employ a man permanently?—If anything of the sort I have suggested was introduced you would get a number of forest experts amongst the land agents. Of course I need not tell you that there are a small number of such gentlemen who devote their time to advising landed proprietors, and you would have men who were capable of advising and giving sound advice with regard to the possibility or otherwise of afforesting certain land. You would have a supply of men of that class.

2427. That is very much needed, is it not?—Yes. Many of these gentlemen would probably have the control of a number of small estates, and devote a portion of their time to each. I think that is the important point. Given a man who has 200 acres or 300 acres, and who keeps a forester, he would have besides the share of an expert who came to him three or four times a year, or perhaps a week at one time and a week at another time, and looked into the details of the work. I think that will be probably the result.

2428. A great many of our timber trees are exotics, are they not?—Of course a great many of them are, but that is rather a ticklish question. There are certain trees which are supposed to be indigenous in this country, and there are others which we know are not; the larch is an exotic tree, and the chestnut and the spruce.

2429. What I was going to ask you is: do you know any other exotic tree or shrub; not for the purpose of timber, but like cinchona, india-rubber, or anything of that sort, which may be planted profitably in this climate?—Neither of those two you have mentioned would thrive here.

2430. Is there anything which the scientific people of the day might direct attention to for planting in this country?—You open a very large question. Kew does a great deal of investigation into that matter. If you ask about particular timber trees I can give you an answer, but about things like cinchona and india-rubber I do not think I ought to say anything.

2431. It is in connection with forestry I think. Is there anywhere in which the land of this country could be employed better than it is at present?—Do you mean by growing any other crops?

2432. Yes; trees grown on poor land can be grown to much better advantage than food?—I think it is highly important that experiments should be conducted with the object of finding perhaps trees or other plants which will do better than those we have, and those enquiries are being prosecuted, but that is all done by the Botanical Department. Probably there is nothing so profitable as larch if it were not for the disease. On the other hand, where you can grow the Douglas fir profitably you probably get double the rent from your land than you get from any other forest tree in this country. I think in this country we have means, where the ground is suitable, to make very high rent by growing ash. Ash is a paying tree. I am afraid this is a very large question, but I am ready to go further into it if you wish it.

2433. We may still with confidence recommend landowners to plant timber as being likely to be an increasingly profitable crop?—I think so.

2434. (*Mr. Marshall.*) With regard to the relative quantities of woods grown in England and on the Continent, first of all as to the relative qualities of fir wood under the Continental system, close together, and that which is grown in England, we have had it in evidence that the Continental wood is so much preferred to the English wood on account of its being cleaner, and better grown, and not so rough, and that the miners prefer it, but we have no evidence at all beyond something that Mr. Margerison said as to the respective qualities of it. Do you think that pitwood can be grown in England of as good a quality as it can be grown on the Continent?—I think so. You must remember there is one particular point. It is generally assumed that the pitwood here in question means Scotch pine or perhaps spruce, and it is generally assumed that this timber with large rings is generally less substantial than timber with small rings. If you grow timber close together you get coniferous timber with narrow rings, and probably get a somewhat better quality. If you grow your trees in this country with just the same limited space you will probably get trees which have annual rings, which are not larger than those of the timber brought in from the Continent.

Professor W. Schlich, C.I.E., F.R.S.

25 Apr. 1902.

except that in some respects the trees in this country will altogether grow somewhat quicker, than around the Baltic. It is rather a complicated question.

2435. With regard to the quality of beech. You heard Mr. Margerison's evidence about that, in which he said that for some purposes the foreign beech was not so good as English, and he gave us evidence to prove that a tree which has more room has more density and toughness?—With many broad-leaved trees it is the other way round: here broad rings probably indicate better quality; it is just possible that the quality may be somewhat superior, but I do not think the difference is very great.

2436. The reason I ask you this question is this. If we are going to persuade landowners in England to plant on the Continental system they will want to know whether they can plant in as good a way and grow timber of as good a quality, suitable for the market, in England, as the imported timbers now coming into this country. I wish to ask you about one thing more. You said with regard to the system of planting larch in beech woods that it prevented disease. I did not quite understand you. Do you mean that you would plant out larch in open spaces in beech woods or start the woods altogether and put larch and beech together?—The system has been developed to this extent. They commenced on the Continent to put the larch singly into woods, dotting them here and there, but lately they plant small groups of larch or little patches amongst the beech wood. The disease probably will be less then for two reasons. In the first place if the disease breaks out in one patch it does not follow that it would spread to the other patches, and, secondly, by putting the larch amongst the beech wood, you give it the best possible conditions you can give it to grow vigorously. The more vigorously the larch develops, the more likely it is to resist disease. Probably, the enormous extent to which the larch disease has spread in this country is due to the fact that it has been planted too indiscriminately on areas where it should not have been planted. Generally speaking, the larch disease in Germany is as bad as it is here.

2437. Do I understand that the larch is planted in the beech afterwards?—The beech on the Continent is regenerated naturally, and when the natural regeneration has been obtained they plant groups of larch into it, or sometimes they begin with little groups of larch and then regenerate the beech.

2438. To some extent you do away with the natural regeneration of the beech wood, because it cannot regenerate while you are growing larch there?—But the larch occupies only a small portion of the area.

2439. (*Dr. Somerville.*) You have supplied a definite scheme on which we ought to be quite clear as to the issues involved, as it will create great attention. You have indicated that what you think would satisfy the requirements as regards higher education would be the establishment of a Faculty of Forestry in the University of Edinburgh, and another in one or other of the two leading Universities of England. By a Faculty of Forestry I suppose you mean not only a Chair filled by a man who would give instruction in sylviculture, but another Chair filled by a man who would give instruction, we will say, in forest mensuration, and another who would deal with working plans, and so on? I take it that is your idea of a Faculty?—I do not know whether we need go quite so far as that in the beginning. I think you might, to give the thing a start, begin with one Professor, or at the outside two.

2440. And perhaps to begin with you would be satisfied by not going so far as a Faculty of Forestry, but rather having a Department of Rural Economy, with forestry in its proper place?—I have already indicated that fact. For instance, it might be combined with Agricultural, or Rural Economy, if you like the term better. There might be one Degree or a Faculty of Rural Economy, but you could take it in one or two ways: you could take it in one way with agriculture as your principal subject and forestry as the second subject, or with forestry as the principal subject and agriculture as the minor subject. You generally have in these Faculties to take a certain number of subjects. I must say I have not worked this out in detail. We have had two botanists who have taken their degrees at Cambridge with botany as their principal subject and zoology as a second subject. You know a great deal more about these things than I do, and I have not gone into the actual details.

2441. One hears from people who are regarded as authorities statements made to the effect that all that one needs in the Universities is that the Professor of Agriculture or the Professor of Botany should attach forestry to his particular Chair, and that would meet the whole of the case. The old Committee on Forestry had a great deal of evidence on that point. What have you to say to such a proposal as that?—No one is in a better position to answer that question than yourself, when we get you in the witness-box. I consider it absolutely insufficient for the purpose. A man cannot serve two masters. The Agricultural Professor, if he is worth his salt, will have probably to bestow such a large proportion of his time on teaching agriculture that he cannot possibly do justice to another branch, and *vice versâ*.

2442. I suppose you would say it is nothing but a fallacy to mention that forestry can be made a Department of Botany?—It is absolutely impossible.

2443. And that, in fact, many people are entirely mistaken when they think that the extension of botany to a knowledge of trees and timber is not a different thing altogether from the study of sylviculture and forestry?—They are absolutely and entirely mistaken.

2444. You are rather determined on the particular point that there should be only extended instruction in forestry of the higher type in one English University?—Yes, to begin with.

2445. I may say that I entirely disagree with you on this particular question, because if you select one University only you will, as a matter of fact, only supply the wants of about one-half of the total number of young landowners and young men who are going into the higher walks of the land agent's profession. I think we may admit that rather a larger number of young men of this kind go to Oxford than to Cambridge, but on the other hand Cambridge has shown a greater disposition to develop in this particular direction. Tradition runs in families to such an extent that a very large proportion of the landowners of England will go to Oxford, no matter what attractions may be at Cambridge in the direction of forestry education, or *vice versâ*. It so happens that in both of these Universities there is a Chair of Agriculture, but the one at Cambridge is better known than the one at Oxford. But there is in Oxford a Professorship of Rural Economy?—On paper!

2446. And now that Oxford is getting so much attention through the agency of the late Mr. Rhodes' will, do not you think there is ample room for the development of the higher education in forestry at both of these Universities?—What you say I practically indicated myself. In the course of my examination I said one as a minimum, because if you ask for too much you would probably not get anything. What I want to be sure of is that we are making a start. Nothing would please me better than to have it at both Universities, because that is the correct thing to do. But if we wish to make complete arrangements, which will really work satisfactorily at both, it would probably involve so much expenditure, etc., that it would fall to the ground altogether. It ought to be at both Universities, and at least in one place in England. I think we must start both in Scotland and England.

2447. We shall no doubt receive evidence from Cambridge on this particular subject, but, speaking from my knowledge of the places, and some small acquaintance with University life generally, I think it is just as likely that we shall see instruction developed at both places as at one only, and I suppose that you would think that distinctly an advantage?—That is what ought to be, but we must take what we can get.

2448. There are in different parts of the country Agricultural Colleges, some 10 or 12 in England and Wales. In one or two instances these Agricultural Colleges have attempted to give instruction in forestry. I suppose you would agree that, if the instructor is qualified, a certain amount of education in forestry might with advantage be given at these agricultural centres?—That forms part of my proposal.

2449. But in some cases the men that have undertaken the instruction in forestry are men who have hitherto taught, we will say, agricultural botany only. I am sure you would not encourage the extension of that particular kind of instruction?—I think not. If there is a short course of instruction in forestry at these Agricultural Colleges it should certainly be instruction of the right kind. But you would not require a special lecturer on

Professor W. Schlich, C.I.E., F.R.S.

25 Apr. 1902.

forestry at each Agricultural College. One lecturer might serve several of the Agricultural Colleges in England.

2450. The supply of qualified men is rather limited; but, as you say, one or two going from place to place to give a term's instruction would probably to a large extent meet the case?—Yes.

2451. (*Chairman.*) You have stated that in your opinion you regard inquiry into the amount of waste land available for afforestation as very important; but you suggest that rather with a view to determine what the possibilities are than to suggest that the State should immediately embark on any great industry in the various areas?—The whole question turns on that inquiry as to whether it is worth while doing anything at all.

2452. With regard to the training of students at the Universities, either in England or in Scotland, seeing that the private forests afford no adequate means of study, and that the State forests are largely composed of waste land, and that only parts of them have been recently put under methodical management, you would doubtless provide in any scheme for the students at the Universities going abroad for part of their practical course, just as they now do at Coopers Hill?—Certainly, until we have the necessary means of instruction in this country.

Mr. Dudley W. Drummond, D.L., J.P., called and Examined.

Mr. D. W. Drummond, D.L., J.P.

2453. (*Chairman.*) You have been for some years managing property in Wales?—I have.

2454. You look after estates there of over 80,000 acres, with about 3,000 acres of woodlands on them?—That is so.

2455. You have studied at Cambridge, and at an Agricultural College?—Yes.

2456. And your evidence will deal more particularly with South Wales?—Yes.

2457. Do you think that if at Cambridge there had been provision for forestry education you would have been able to benefit by it?—No, I do not think I should, not under the then existing system at Cambridge. There are no methods of studying practical forestry there—at any rate, there were none in my days.

2458. I meant rather that if there had been provision for forestry instruction there, adequate provision, forestry classes and a demonstration area, that you could have visited from Cambridge, you would have derived benefit?—If there had been facilities, yes.

2459. Did you ever feel the want of a thorough training in sylviculture?—I have felt it very much, and noticed it very much everywhere.

2460. Do you think many land agents have the same feeling?—Yes, I think they have. I never met any that ever had much real practical experience or early training.

2461. Do you think that for the management of woodlands it is equally important to train the owner and the agent and the forester?—Yes, I think it is.

2462. All three?—Yes, all three.

2463. Which do you think needs it most?—It depends very much. Very many landlords take little interest in their properties, and leave it entirely to their agents. I think it is most important that the agents generally should have that special training.

2464. Are foresters sufficiently educated?—No, in my experience, certainly not.

2465. Have they sufficient general education in your part of the country to enable them to derive full benefit from a theoretical training in forestry?—No, I do not think the local foresters have it. In the principal estates I look after we have a Scotch forester who has had a good general education, and he has had a good practical experience of some of the leading Scotch estates, but he has not had a practical forestry training otherwise.

2466. But that, I suppose, he might get in this country?—No, not under existing conditions.

2467. Which agricultural college were you at?—Downton.

2468. We had evidence from Downton before the Select Committee in 1887. Was there any effective provision for forestry training there?—No, there was very little. Of course, there is a large area, the New Forest, quite contiguous; but at the present moment there is not very much to learn in the system at the New Forest, I think.

2469. The prices of wood seem to be low in South Wales?—Yes, they are very low.

2470. That is partly from expensive transport?—A great deal from expensive transport. The quality, as a rule, is inferior. The country is very hilly, and haulage consequently difficult. The roads in many cases are bad.

2471. Have you tried any traction traffic?—No, none at all.

2472. Do you find yourself in keen competition at the local collieries with French and Swedish pit-wood?—Yes. They import a great deal of this pinaster wood from the South of France.

2473. Is that brought to the market much cheaper from where it is grown?—Yes; it comes over at about 6s. or 7s. a ton delivered to the local Welsh ports, and our general railway rates within the county are almost double that. In all the local collieries you will see the sidings flooded with this pinaster and Scotch fir timber.

2474. There has been no attempt to compete with the railways by steam traction on roads?—No, not so far. it is a very difficult thing to organise There is hardly any landlord who has a sufficient area of wood land to justify that expenditure, and the plantations are so far apart. There is no large area that you can deal with.

2475. Have any of these wood-lands been planted for commercial purposes?—Yes, a great deal.

2476. But in too small areas?—Yes, I think so.

2477. Is there much land available for afforestation?—Yes, there is a great deal of waste land in the western part of Wales, thousands and thousands of acres of Crown Manor and other manorial waste, which could be very properly planted, bringing in practically nothing nowadays.

2478. Is there much land free of grazing rights?—No, that is a difficulty. There is very little land that has not grazing rights attached to it, and though the grazing rights are important in a way, they are really of very little actual value.

2479. Do you think that the landowners will extend the forest area to any great extent in Wales?—I do not think they will at present unless they get greater encouragement from some quarter to do so.

2480. What sort of encouragement do you think should be given?—I think some assistance in the rates might be given. I think it was a great pity woods were not brought into the Agricultural Rating Act.

2481. Why were they not, do you know?—I do not know.

2482. The rates at present are very high, are they?—Yes, between 7s. and 8s. an acre, rates and taxes generally.

2483. Is the tithe heavy?—The general rates average about 4s. in the £, and then you have income tax A 1s. 3d., B running into 5d., tithes 1s. 8d., and land tax 3d., which comes to 7s. 7d. in the £, rates and taxes alone. I think it would be very desirable if it were brought home to landowners in some shape or other how important planting is. I do not think they realise the scarcity of timber there is in the world.

2484. I suppose that what would lead them to realise the importance of it would be some evidence that the growing of wood would pay?——Yes. Then, of course, they have to wait for some years, and people nowadays in farming and arboriculture and everything look only to early profit.

2485. Do these plantations which you manage pay?—It is so very difficult to say, because there are no proper returns made. So far as my experience goes, on no estate is there any proper book-keeping kept of the various plantations. They do not stand very severe cross-examination in the accounts.

2486. You can only show what profits are by accurate book-keeping?—That is all. Still, under certain conditions, if the wood turns out favourably, and is planted in favourable situations as to markets, I certainly think

Mr. D. W. Drummond, D.L., J.P.

25 Apr. 1902.

it pays well, but, of course, it is a risky crop in so many cases.

2487. Do you think that the State should undertake planting operations?—Yes, I think they should.

2488. And I suppose you would not go beyond any tentative scheme at the beginning, because you have already said there is a deficiency of trained foresters in the country, and a great deficiency of information as to the best kind of trees and the best mixtures to plant?—There is a great deal of that, but as regards the quality of the trees, and the situation suited to them, they can be pretty accurately gleaned from local inspection. That is what I go on in planting myself. I go about the country, and see what trees suit the particular local districts best, and plant accordingly.

2489. Do you think that a good course in sylviculture at Cambridge or Oxford would be of great advantage in interesting landowners and others in sylviculture, and would equip many agents who go to these Universities for the better discharge of their responsibilities?—I think so. I think you could get a very good theoretical training there, but I do not know that these places are very well situated for practical work.

2490. You think that the practical work is very important?—I think it is very important.

2491. And it is important also for the foresters?—It is important for the foresters more particularly.

2492. From what you said, I imagine you would rely chiefly on practical demonstration for training foresters?—Yes.

2493. (*Mr. Marshall.*) You have told us that there is a good deal of risk about growing timber down in South Wales. With regard to larch disease, do you get that badly there?—We have had it very seriously, but the trees have recovered a good deal from it now. Five or six years ago we had a very severe attack of it.

2494. Have you tried mixing other trees with larch, or do you plant larch plantations clear?—I almost invariably now mix the trees.

2495. What do you plant with larch?—We generally plant Scotch firs, and *Laricio* I am going in a great deal for.

2496. Do not you find *Laricio* very slow?—Very slow at starting, but they quickly grow, and stand in places where others will not stand at all.

2497. Have you tried Douglas at all?—Not to any great extent. I had the intention of doing so, but I cannot say I have done so yet. But all the spruces do remarkably well in our county, and I think it is a great pity more are not planted.

2498. You say this foreign pit-wood comes in and spoils your trade there, blocks up the coal pits—chiefly pinaster and Scotch fir, and you also say that they get it over at about 6s. or 7s. a ton?—Yes.

2499. Therefore you find it impossible, owing to the high rates of railway carriage, to compete with it? Do not they give you a better price for larch for pit-wood than they do for foreign wood?—Yes, it commands a better price than the foreign pit-wood, but the latter, like all foreign agricultural products and everything else, is beautifully prepared for the market. All this pit-wood comes in cut to the exact size required, and is put straight on to the trucks, and goes to the collieries without any cutting about.

2500. With regard to rates, you have kindly given us particulars which amount to 7s. or 8s. an acre, rates and taxes altogether, and I think you said you were very much of opinion that the wood-lands should have been on the same standing as agricultural land when the Agricultural Rates Bill came in. Do not you think you might go a little bit further than that, and suggest, for the relief of proprietors who are prepared to lay out some money in plantations, that they should be if possible relieved of rates altogether for a period of about twenty-five years?—Yes, until some income is derived from the plantation I think it would be only fair.

2501. Twenty-five years would be about the time?—You might expect to make a little then.

2502. You would not get it out of your larch and fir plantations at ten years old?—No, and in twenty-five years you would only about keep up the working expenses.

2503. We had some interesting evidence yesterday about the mountains which were leased to the tenants for their sheep runs, with the land that lay below, and Lord Glanusk, who kindly gave evidence on the point, was very much of opinion that it would be a most unpopular thing to take the runs away from farmers and plant them?—No doubt it would be. I mean that the actual financial loss would be small, and that the gain to the country would be generally very great. That is the way I look at it. No doubt the local farmers would rise up in a body against it.

2504. What would be the result supposing a farm down there fell in, and you only let the low-lying land, and took away the sheep portion?—In many cases you cannot enclose the mountain land.

2505. Is it Crown land?—Whether it is Crown land or belongs to the lord of the manor, as a private individual, is just the same. The farms adjoining the mountain have rights of pasturage on the mountains, but they are only exercised in the summer. In the winter time the stock have to come down on the low farms. Each of the farmers can only maintain on the open mountain such an amount of stock as he can keep on the small holding during the winter, and the class of sheep are very inferior, and their value is very small. They average about 12s. or 14s. each for a full-grown sheep.

2506. I see you also advocate a bounty. Do you think a bounty would work? If the Government gave a bounty on every 100 acres of wood land planted by private individuals, would it help?—I think it would conduce to planting.

2507. That would be really a more practicable scheme than the relief in the rates, do not you think?—Perhaps it would be. I do not know whether it would be so easily obtained.

2508. As far as labour is concerned, I think you mentioned that the labour is not reliable?—The greatest difficulty we have to compete with is labour in Wales at the present time. Labour is very dear and very inferior, in fact, you cannot get labour for love or money at all down there.

2509. You say that you can occasionally get the nurserymen to take a contract?—Yes, occasionally, in certain parts there are one or two small nurserymen who do that.

2510. Would not planting be done by contract through nurserymen as well as it is done by your own woodmen?—No, I do not think it is.

2511. They would be likely to put in a lot of plants that could not be sold to anyone else?—Yes, I think one's own staff is more dependable—on small estates they do not keep a proper staff.

2512. On the fencing question, Lord Glanusk rather astonished us yesterday with the price of his fencing. He said he could not put an ordinary six-wire fence round a plantation under about 1s. 3d. a yard?—About 1s. a yard is the price.

2513. That compares very highly, indeed, with the cost of the fencing in Scotland. Do you consider that, supposing you fence off a bit of land for the sake of planting, the cost of the fencing should be borne by the wood-lands, having regard to the fact that trees would not walk away by themselves—you only have to put up a fence to keep things out. Should not a part of the cost be borne by the agricultural land, and not be all charged to the woodlands? Would it not be a fair thing to do that?—I do not know that it would be quite fair. If you are going to fence in a certain amount of land for the purpose of forestry, you ought to charge it to that department. No doubt it would be a greater relief if it could be devised in some other way.

2514. Your young woods in South Wales are a great deal damaged by sheep getting in, even though you do fence?—Yes, they are.

2515. And there is a difficulty in keeping them out?—Yes, it is a difficulty.

2516. (*Sir John Rolleston.*) You said that grazing land in South Wales would be much more profitably employed in growing timber than in agriculture?—Yes. There is a great deal of this mountain land which is grazing pasture let out at from 9d. to 1s. 6d. an acre. Even under the worst conditions of forestry you would get something more out of it than that.

2517. Timber would be a much more profitable crop?—Timber would be a much more profitable crop, and a great advantage in the way of shelter in the uplands, by sheltering sheep-walks. What the tenants would lose in many cases by certain areas of land being taken into forests, I believe they would gain very much in the shelter which those forests would afford.

2518. You import pit-wood timber very largely from France and Sweden, do you not?—Yes, mostly from French ports. These little sailing vessels come into the local Welsh ports for anthracite coal. I may say that about 75 per cent. of the anthracite coal, which in the eastern part of Carmarthenshire is a very large industry, is exported, and these little French sailing vessels come over and fetch this anthracite coal, and bring French pit-wood to this country as ballast.

2519. If your hills were planted you would be able to supply that demand yourselves?—Yes, a great deal better than we can now.

2520. Has the rain-fall any bearing on the growth of trees?—Yes, I think it has. I think the excessive rain-fall that we suffer from is against our plantations.

2521. In your statement that you have kindly furnished to the Committee, you say that the rain-fall is somewhere between 35 and 50 inches?—Yes.

2522. And that is against tree-planting?—I do not know that it is absolutely against tree-planting, but I think the excessive rain-fall we have is against the promotion of healthy growth. We get too excessive a rainfall as a rule, and the soil is heavy clay shale mostly.

2523. (*Colonel Bailey.*) The pit-wood that you speak of as grown locally is chiefly larch?—Yes, it is chiefly larch.

2524. Is it altogether larch?—Not altogether; there is a certain amount of Scotch fir and spruce sold as well, but the larch is the only pit-wood that commands the best value, and it does command a very good value.

2525. You said, as I understood you, that you thought it was a pity more spruce was not planted?—I do think so.

2526. What would that be sold for?—It can be sold for planking very well, and for building purposes generally. There is no reason why we should not grow as good spruce as what is imported into this country from abroad.

2527. Is a good deal of spruce wood actually imported now?—A great deal.

2528. For what purpose?—For building purposes very much, and there is a great rage for building in my district.

2529. I believe that there is a feeling with a good many people in this country that we cannot grow good spruce. I hear it said very often that it is no good growing spruce; is that your experience?—No, I find spruce growing most luxuriantly. It branches out and gets knotty, but that is the fault of the system under which it is grown.

2530. Is not a good deal of that land, which I believe is wet land, good for spruce rather than for larch?—I think so. I have gone in for them a good deal myself, planting more spruce than larch lately.

2531. (*Professor Schlich.*) With regard to the grazing rights of the farmers, do you think the difficulties would be altogether insurmountable to get an extended area of afforestation in South Wales? Of course the farms have grazing rights, and these rights are simply conferred by the lease of the farm, are they not?—No.

2532. They have proprietary rights?—They have rights of occupation connected with the farm. Very often the farm is owned by one person, and the commons are vested in another person.

2533. Belonging to another proprietor?—Yes, another proprietor as lord of the manor, and the occupant has inalienable rights to the pasture on the open mountains.

2534. So that it would be difficult to get hold of these areas for additional wood-lands?—I do not think it would be difficult.

2535. Would it be insurmountable?—I do not think so.

2536. We had a case in the catchment area of the Liverpool Waterworks, where a large area was cleared entirely of these rights?—That is so.

2537. Do you happen to know whether it was a very expensive process?—I do not know the details of it, but I know it was so, because I have been in that district.

2538. You do not know whether it was very expensive?—I cannot remember the details offhand, but I see no great difficulty in regard to it.

2539. At any rate, you see no difficulty in a portion of these grazing lands being put under forest?—No. It would be a good thing to have some experimental plantings made in those large areas, and it could not affect the grazing rights at all; it would improve them in many cases vastly.

Mr. D. W. Drummond, D.L., J.P.

25 Apr. 1902.

2540. In your memorandum (*Appendix X.*) you say that there is little intelligence shown as to the selection of trees for particular situations, and a lamentable mismanagement generally in their subsequent treatment?—That is so.

2541. That is your experience as manager of 80,000 acres in South Wales?—Yes.

2542. That is certainly your experience?—Most certainly it is.

2543. Another point is that you say that in cleared areas you quickly replant a felling area to a certain extent, whenever opportunity arises. Do you consider it not only advisable, but practicable, to replant quickly?—I think the quicker the better.

2544. We have had different evidence on that subject, and I am glad to hear you say that?—The great object is to conserve the fertility of the soil, and that is a great difficulty in all our Welsh plantations.

2545. You do not wish the soil to lie for a number of years exposed to all the atmospheric influences?—No, and in many Welsh plantations you will not find they have an adequate crop on the ground.

2546. The producing capacity of the soil decreases if you let it lie unoccupied?—Most certainly it does.

2547. You also say that you are of opinion that people who practise forestry, so far as your experience goes, seem to have less technical knowledge of their subject than those engaged in any other profession?—Yes, I think so, so far as my experience goes.

2548. So that we are behindhand in forestry?—Very much so.

2549. I think you say in your memorandum that what is of special importance is that estate managers should have the opportunity of becoming acquainted with the correct principle of treating forests. I cannot put my hand upon the quotation at the present moment, but I think that is what you say?—I think it is a remark of mine. I do think it would be very desirable. Even people in my position—I should have been only too glad to get the advantage of short courses in forestry.

2550. You were at the University of Cambridge, and afterwards you went to an agricultural college? Supposing there had been an opportunity, apart from your ordinary degree, of attending some sensible instruction in forestry, say a moderate-sized course of lectures combined with practical instruction on suitable areas in the vicinity, would you have been likely to avail yourself of that opportunity?—Yes, I think I should have. The difficulty is, both in this case and at the agricultural colleges one does not get enough practical work. The thing is all too theoretical. At that age, when at the University, one does not realise the importance of these things as one does in after life.

2551. When you were at the college had you some idea that you were going to devote yourself to that occupation?—I had.

2552. That being so, do you think that if an opportunity had been offered to you at Cambridge for attending a course of sensible length, with some practical illustrations in woods, you would have availed yourself of it?—Most certainly. I commenced a course in mechanics there with the same view. It was the nearest thing I could get that was likely to help me in my future profession.

2553. Do you think other gentlemen like you would do the same thing?—I do.

2554. Therefore, it would be a distinct improvement if education was given at the different universities?—I think so. The difficulty is, that there is no scope for practical illustration in those places.

2555. That would be the difficulty, but that might be got over in the course of time. Until we have such opportunities, gentlemen like you who go to the university can spare the time to go for a week or two weeks to the Continent, where practical instruction can be given?—That could be done.

2556. That would be part and parcel of the business until we had the necessary means of instruction in this country?—Yes.

Mr. D. W. Drummond, D.L., J.P.

25 Apr. 1902.

2557. But you are decidedly of opinion that it would be a very good thing for the country to have these means in our universities to instruct gentlemen who are either sons of landowners, or who propose to devote themselves to the higher class of estate agents' work?—I do think that, but those particular centres of our leading universities are as good as some others. I had in my mind Cirencester and Downton, where there are large forest centres at hand.

2558. We have them in our mind, too?—Yes, I should be only too glad to see some forest education anywhere.

2559. Supposing there is a high-class system of forest education, both at Oxford and Cambridge, where gentlemen of your position go, do not you think it could be done as well there as at agricultural colleges, if the necessary areas of instruction could be made available?—Undoubtedly. I do not think the situation of the place would make any difference to the quality of the learning you get. Perhaps at Oxford and Cambridge you would get it better, and they might have more money to devote.

2560. You spoke of spruce woods. Have you any spruce wood in Wales under your management, of any age?—There are very few pure spruce woods.

2561. They are mostly larch, I suppose?—Mostly larch, but what spruce we have got are growing remarkably well. I have a very great opinion of spruce myself.

2562. In a moist climate like Wales spruce ought to be a good crop?—Yes, and it is not only the soil, but the climate which seems to influence its development.

2563. A portion of the pit wood in Wales is spruce?—Yes, a portion; but larch is far and away the best, because it stands a far greater strain. I have seen larch in pit-props double like my elbows under the strain, whereas none of the other woods would stand that.

2564. Supposing that larch disease spread to such an extent that the production of larch in Wales was practically no longer possible, do you think the mines would, to a fair extent, use spruce if they could not get larch?—I think they would, a good deal of it goes in that way now, and the spruce is far better than the pinaster.

2565. That comes from Bordeaux and those places, does it not?—Yes. The point is that it is cheap, and comes cut in lengths ready to be put straight in. There is no further handling required.

2566. They bring it cheaply because they use it for ballast when coming for anthracite?—Yes.

2567. (*Mr. J. H. Lewis.*) Do you think that if the Board of Agriculture were to publish pamphlets or leaflets on the subject of afforesting it would be any advantage to foresters generally?—I think it would be very advantageous, and I think if one had a practical forest hand-book it would be a great advantage: something like Dr. Fream published a few years ago on behalf of the Royal Agricultural Society. I forget the title of that book, but I think it was called "The Elements of Agriculture." It is a practical book within the reach of everybody. Most of the forest literature in my experience is too abstruse for the ordinary observer to grasp. People have not time, unless they are going to make a special study of it, to go into these abstruse details. The literature in connection with forestry should be made more popular.

2568. I think it is your opinion that the future successful prospects of forestry turn on the recognition by proprietors of the importance of extending and conserving their woodlands, and that public means should be adopted to impress these upon them. What public means would you suggest?—I mean the issue of leaflets, and, if it were possible for the Government of the day to assist in another way, then they should do it in some form or other. But I do not think, so far as my experience goes, that landowners do realise the importance of it, and I believe that the many years during which their capital is tied up, and the risks it has to undergo during that period frightens them.

2569. But you think if it were possible for the State to undertake on a limited scale afforesting, as the State does not die, and can afford to wait for a return, there are areas of land, particularly in Wales, which might be profitably afforested by the State?—Most certainly. I should be very glad to see that done. I believe it would give a tremendous fillip to forestry generally if the State undertook some experiments of that sort. That would be one of the methods by which it would be brought home to local proprietors throughout the country.

2570. If there are difficulties in the way, it would be worth making a strong endeavour to overcome those difficulties, in order to obtain so desirable a result?—I think so.

2571. Up to what height do you find that afforesting pays?—We have very few plantations over 700 or 800 feet elevations.

2572. I thought you said you planted up to 1,500 feet?—No; I should have said that the lands under my management rise to an elevation of 1,500 feet; in those upland districts there are great bare cwms and valleys, which might be very well planted. But, of course, the valleys themselves do not reach that elevation.

2573. Do the railway companies in your district give preferential or differential rates to timber imported from abroad?—I do not know that they do exactly. In our part of the country we are entirely in the hands of the Great Western, and likely to be for all time I am afraid now. I do not know that they actually give preferential rates; I cannot speak from personal knowledge.

2574. Do you consider that the railway companies' rates are unduly high?—Yes, I consider they are.

2575. You are, of course, in the hands of one railway company, and, therefore, you cannot help yourselves so far as that is concerned?—No. They run up to the Midland districts to about 30s. to 35s. a ton of 40 cubic feet.

2576. Have you considered whether, by means of steam traction, it might be possible to overcome this difficulty by creating competition with the railway company?—I have often had that in my mind, but we have great difficulties to contend with with regard to the local authorities. The bridges are not very good, or some of the roads are not good, and then the County Councils and District Councils come on top of you for extraordinary traffic, and you do not know where you are.

2577. Do you find much difficulty with game in young plantations?—Not much. It is not a very heavily preserved country in the way of game in our parts. When you are first planting you sometimes have difficulty, but we do not suffer much from game.

2578. Comparing the parts of Wales with which you are familiar, with other parts of the country which you have seen, you would say that there are large areas which can be profitably afforested?—Most certainly. I think many of the farms on our estate would be far more profitable and far better under wood than they would under farming, because the rents are very small in many districts, and do not pay the cost of maintaining the buildings very often.

2579. (*Professor Campbell.*) In the summary of your evidence you say that the Land Improvement Companies might more fully advertise their loan systems. Have you any knowledge of the working of these loans?—Yes, I have a certain amount of knowledge. I act under the Board of Agriculture as inspector in connection with these loans.

2580. Are these loans of any advantage?—I think they are of great advantage to landowners situated in certain circumstances.

2581. Are they being taken advantage of?—They are for building in a small way, but not very great.

2582. I meant for forestry?—No, not for forestry. I have had no experience of that. People do not seem to be aware of it.

2583. Do you know a single case where a loan has been granted for forestry?—No. I have been their inspector for eleven years, and I have not had a single instance of an application for forestry purposes.

2584. There is another question which I am afraid is not a fair one to ask you. We have had the term "waste land" mentioned here several times, and I have not yet had any definition of that term. I see you make some reference in your statement to this class of soil, which leads me to think that you might be able to give me a definition of it?—What we generally term "waste land" in our part of the country is waste of the manor, that is, the unenclosed mountain land, of which in some instances private proprietors are lords of the manor, and in other cases the Crown. Such lands are invariably subject to pasturage rights of the tenants whose farms adjoin. That is what we generally describe as waste land.

2585. You do not mean lands of very poor quality, necessarily?—No, but there is a very great deal of that kind of soil—in fact many of our farms are of very poor quality, and would pay far better under arboriculture than agriculture.

2586. (*Mr. Stafford Howard.*) Does your experience go to show that there is an increase in forestry among landowners?—I am afraid it does not.

2587. Not in your part of the country?—No. People are doing nothing but cutting all the time, and very little or no replanting.

2588. You are very strongly of opinion that it is high time some steps should be taken by the Government or otherwise to call attention to the subject?—I am very strongly of that opinion. There is a great deal of cutting of these old oak woods especially and they are merely left to grow up from the old stools.

2589. Would you like to see a law that if a man cuts down so much he is bound to plant so much in its place?—It would be rather an arbitrary one, but personally I should like to see it.

2590. You say in your statement that in Wales in particular there is great mismanagement, and an enormous unproductive area, which could profitably be planted and largely increase the value of its resources, and greatly improve the surrounding land by shelter. You have, I think, something like 80,000 acres under your charge, and a good deal of that would come under that description, would it not?—A good deal of it.

2591. Are you doing something on the estates you manage to carry out your views?—I am as far as possible, but there is really so much to do that it is difficult to get through with it, and the state of the labour market makes it impossible to extend the forestry operations as I should like to. But I have seen many instances of the value of shelter on the mountain for sheep walks by planting. One cannot get labour for love or money at all. The ordinary labourer will not come under 4s. a day in some parts, and is very little good at that.

2592. With regard to the land which you manage, I suppose in the case of these waste lands you have just described the lord of the manor and the owner of the adjoining farms is the same person in some cases?—In some cases.

2593. And those are the cases where it would be easiest to carry out any such scheme, where you have one owner of the soil throughout?—That would be so.

2594. Where you have two owners, difficulties would be sure to arise?—Yes.

2595. Even if you had the case of one owner, if you plant any considerable portion of one of these wastes over which the adjoining farms have grazing rights, you are bound to interfere with the grazing rights of some particular farm?—Under other proprietors?

2596. No, of your own?—Yes, you are.

2597. Assuming you have a mountain and all the land around belonging to the same proprietor, if that proprietor wants to plant a considerable area of that mountain, he must interfere with the grazing rights of some of the farms, for the reason that the sheep of the farms go on certain parts of the mountain?—That is so.

2598. Therefore, you take away not a certain proportion from each tenant, but, practically, the portion of one or two particular farms?—That is so. There are no boundaries, but the sheep along these particular farms are in the habit of occupying certain portions of the waste.

2599. You said just now in answer to a question that if these plantations were made, the tenants would gain in shelter what they might lose in area; but some of them would gain in shelter, whilst the others might lose in area?—They would lose the particular areas on which they pasture their sheep at present.

2600. It would not operate fairly between the different tenants?—It might not.

2601. You would have to be guided in selecting your area by what would be suitable for planting?—Yes.

2602. You would not be guided by the object of only taking a certain proportion from each tenant?—No.

2603. Then there would be a difficulty?—It would be a difficulty, and there would be hardships; but, in my opinion, the financial results generally would be far greater.

2604. Supposing a farm came into hand, and was to let, if you took that farm in hand you might then plant the sheep-walk?—You could, with the general consent of the homage of the manor.

2605. Even if the whole property belongs to the same owner?—In that case there would be no difficulty.

2606. When a farm falls in, and is to let, then you might deal with it?—Yes, I think the lord of the manor has legal rights to enclose a certain portion of the manor as long as he does not interfere with the rights of the homagers.

2607. That possibly involves a legal question, and it may be a law suit?—There are legal difficulties, no doubt.

2608. But still, if those difficulties could be surmounted, you think it is a thing very desirable to be done?—Yes.

2609. And so far as you have the opportunity, you are trying to do it on the estates under your management?—Yes, and in these waste manors there are great portions not suitable for pasturage at all, which would grow trees very well. Some of these deep valleys and cwms are practically not pasture at all, whereas in many cases they would grow timber very well.

2610. You said that your idea of forestry instruction would be rather in connection with an agricultural college?—I think so.

2611. Better than Oxford and Cambridge?—I think so.

2612. When were you at Downton, was there any special forestry instruction there?—No.

2613. It has been established, as I understand, since then, as they have it now?—I do not know whether they have. There were certain lectures bordering on forestry education, such as surveying and things of that kind, but no forestry education.

2614. How many years ago was that?—That was in 1884.

2615. It would be a great advantage to these colleges if they could have an area set apart for their special instruction?—Yes, it would be. If the Forest of Dean was near the college, and the New Forest near another college, it would be a very great advantage.

2616. Would it not be of still greater advantage if those who gave instruction to the forester had the management of the instructional area, as well as the opportunity of going over a larger area planted by some one else?—No doubt it would be, if it could be done.

2617. (*Chairman.*) I see that Professor Wrightson in 1887 said that forestry lectures were delivered at Downton, by Mr. Curtis, and Professor Fream also assisted in teaching botany. There was nothing of that kind when you were there?—Yes, Professor Curtis used to lecture there in my days on estate management, and there was a certain amount of elementary botany, physiology, and subjects of that character given, but not in special relation to forestry at all.

2618. They had apparently a very full syllabus of forestry in 1887, but that was after you were there?—Yes, I had no practical results from my training there in that particular line.

2619. Is all the rough ground in Wales practically held under these grazing rights, so that you cannot get at it for planting?—Practically, that is to say, what we call the waste of the manor, the open land. There is a great deal of rough land on the enclosed land, which might be very well planted, but, of course, you could not have a large forest scheme there like you could on the open wastes.

2620. All the large areas are held under these grazing rights?—Yes, practically, in my country.

2621. Have you had any case of claims for extraordinary traffic brought under your notice?—Many.

2622. Are they generally given?—Yes, they are invariably given. It leads to a great deal of quarrelling. I have seen some extraordinary claims put in by district councils against proprietors who have cut timber and carried it away.

2623. Do you think they are commonly excessive?—I think they are; it is a thing very difficult to gauge, and I am always very careful in my arrangement with buyers now.

Mr. D. W. Drummond, D.L., J.P.

25 Apr. 1902.

2624. Do you think that the land-agent or the forester should be mainly responsible for the condition of the wood-lands?—I think it is a double responsibility. Of course, the landowner looks to his agent, and the agent really looks for the details to his foresters.

2625. When you come to the ground floor, the forester is responsible?—Yes, but the agent is the man who is responsible to the landlord.

2626. He, I suppose, has not very much time to give to forestry?—That is the difficulty. The agent has to be everybody and do everything.

2627. And that makes the head forester an important person?—Yes, it does.

2628. You think there is a great deal of land under farms which does not pay a rent equal to the interest on the fixtures, that is, the buildings, the drainage, the fencing, etc?—Yes. Our farms in Wales are very small, they average somewhere about 60 acres, and they are rented at about 10s. to 12s. an acre. Every farm requires its dwelling-houses, its cowhouses, stables, barns, pigstyes, etc., and you cannot do it, with the present price of labour and materials, under £700 or £800.

2629. What is the rent you think it is profitable to have under agriculture in Wales?—I would not plant land for which you could get over 10s. an acre.

Mr. A. Pitcaithley.

Mr. ALEXANDER PITCAITHLEY, Forester, Scone, Perthshire, called; and Examined.

2630. (*Chairman.*) You are Forester at Scone?—Yes.

2631. You think that it is impossible to give any perfectly accurate results of growing timber?—There has been no record kept, as far as I am aware, anywhere.

2632. And you think those records are very necessary?—It is very necessary to have an accurate idea.

2633. But in spite of the want of records you think there is sufficient evidence to show that timber growing in many cases has paid very well?—There is abundant evidence everywhere.

2634. And you give two illustrations from Scone?—Yes.

2635. Is it within your knowledge that in other properties very good returns have been made from land which was comparatively valueless for any other purpose?—Yes.

2636. These examples you give, however, are unusually good ones?—Yes. I may say that the management in Scone has been an exception, too. Forests in Scone generally have been always under comparatively good management compared with some other estates.

2637. The soil is good for trees?—Of course, but the soils are variable. The mixed plantations of hardwoods are on very good soil.

2638. Is there any evidence to show whether these trees have been protected from ground game in their youth?—I do not think at that time the ground game was a nuisance in Scotland. I think that rabbits hardly existed 90 years ago.

2639. You can hardly say that now?—No. There were none in Scone anyhow 90 years ago.

2640. But with very few exceptions, you would say that all over the country woods are bad?—Miserable.

2641. To what cause do you mainly attribute the condition of the woods?—Bad management, or the want of knowledge of good management. That is the main reason, but there are other reasons. About 30 or 40 years ago a better price was given for pit props than is given now, and that induced many people who needed money to realise as much of their woods as possible, and, in the absence of advice from managers, it was done, with the result that they were doing damage when they thought they were doing right. That was an inducement to overthin. I am not referring to Scone just now, but to my experience on other estates.

2642. I suppose also that in many wood districts of the country, where the land is occupied by agriculture, and yet peculiarly suited to the growth of timber, the proprietors are very often in the least favourable position to find money to plant—that is, over a great part of the Highland area the proprietors have less resources and the greatest amount of suitable land to cultivate?—That is so.

2643. You do not think the timber area will increase very rapidly if it is left to the resources of the proprietors?—It occurs to me that before we increase our area we ought first to properly manage the areas we have. There are great areas in the Highlands and other parts of Scotland nominally under a crop of trees, and we do not want at once to acquire further land until we do something with the land we have already got. It occurs to me there is a great deal to be done on areas which are nominally now under wood.

2644. And, therefore, you attach great importance to an instruction college?—That is the first step, I think.

2645. That is the most necessary thing of all?—To begin with.

2646. More necessary even than theoretical training?—Yes; I think it must go hand in hand. Practical training is not of much use without the theoretical, neither is the theoretical without the practical.

2647. What is your view of the best method by which the two can go together? Would you have a Forest School?—A Forest School is very necessary, but whether the theoretical training should come first I do not know. I think the practical training is the first thing we should try and get. There are other things besides growing trees that a forester requires to know. In dealing with private owners' land, there are other things, such as the general management of the estate. He must have a thorough understanding of his position or future position as a forester on the estate before he gets stuffed up with theoretical ideas. He is very apt to have something to do with the management.

2648. If you wished to train a young forester for a head forester now, you would begin with him as a boy, under a forester on a well-managed estate?—Yes, as a lad. Boys are not much use. Until a young man's opinions are formed, he does not know what he desires. Many boys do not know what they intend to do. I think a man must have his mind made up as to his profession. They must be taken very young.

2649. When he was competent to do his best in an instruction forest you would send him there for a time?—Yes, to a course of theoretical training.

2650. Then I suppose he would have to earn enough to keep himself in food and clothes?—Yes, that is my idea. I have not given the thing any great thought, and I have no means of knowing what would be the most suitable way of working out the theory. I only know that such instruction is entirely necessary. I speak from experience; I know the want of it myself. I had no theoretical training, and I have felt the want of it.

2651. Have you not got some young men at Scone now?—We have adopted that plan. Lord Mansfield has arranged that when I take a young man on, I do so on the understanding that he is to stay three years before he leaves. He can leave at any time, but I tell him he must not expect assistance if he does leave, and I find it works very well. The young man, knowing that he is thought of and looked after, comes to Scone. During the time that there has been a complaint as to want of labour, I have had no difficulty in getting young men. They are always willing to come, and want to come.

2652. And they wish, as a rule, to get an education there?—Yes, that is their idea.

2653. Are they well enough educated to become head foresters?—The majority of them, I think. They are a superior class of young men that I get.

2654. Do they take every advantage of any instruction that is given to them?—Yes, they appeal for it.

2655. And any experimental area or instruction forests should have demonstrations in the growth of timber, in its manufacture, and transport, and in all the departments of the forestry business?—Yes.

2656. Do you think a head forester should be able to work up his own timber?—He ought to have the ability of doing so. It is not always necessary, possibly. In certain districts, where there is keen competition—such as where we are situated—I think it is not necessary to go to the expense of plant to work up the timber. We get the full value of our timber by selling to the timber merchant, and I think in our case it does very well.

2657. Are you responsible for the woods at Scone?—Yes.

2658. Have you any method of working them, or do you just make a report year by year what you intend to do?—I make up an estimate from year to year, the proposals for work done during the year, and report on the work done for the previous year, and the cost. I keep a record of it all.

2659. I see you think it would be a great advantage to wood-lands if warrens were formed?—That is our greatest grievance, the rabbits.

2660. What is the wood-land area at Scone?—Nominally, about 7,000 acres, but they are not all fully cropped.

2661. Under good management you think that land making less than 10*s.* an acre would do better under wood?—Certainly, if it is suitable for a timber crop.

2662. You would acknowledge that there is a great deal of land which pays very well at present, grouse rents, and you say yourself you think you have enough to do for some time to come in making the existing wood-land perfect?—That is my idea.

2663. Is Perthshire a good centre for a Forest School?—I should think it is the best for Scotland, for it is the most convenient.

2664. Are many foresters trained in Perthshire?—I think the majority come from Perthshire. The English foresters mostly all come from Perthshire too.

2665. There are a very large number of foresters bred there?—Yes. And they go to all parts of Britain.

2666. And you think that foresters, as a class, are fully capable of taking advantage of instruction, and fully alive to the deficiencies of the training that they receive at present?—The majority are. There are a few who do not think so.

2667. Do you think they would profit by any facilities?—Undoubtedly.

2668. Do you think there is any revival of interest amongst factors and landowners in forestry generally, or do you think things remain as they were?—I am afraid they are very much as they were. At least I cannot say I have observed, except in certain districts, any great improvements.

2669. (*Professor Campbell.*) How many men do you employ on the 7,000 acres?—I have also the general estate work to supervise, and my men are not altogether employed in the forest. They do other estate work as well, fencing and draining. Therefore, I could not give you the number.

2670. (*Mr. J. H. Lewis.*) We have had it in evidence that in regard to the land in England and Wales, which might be perhaps profitably afforested, difficulties have arisen owing to grazing rights which the owners possess on those lands. Could you tell us to what extent that difficulty would be an obstacle in Scotland?—I do not think it would be felt. I cannot speak authoritatively, but that is my opinion.

2671. Those rights do not exist in Scotland to the same extent that they do in this country?—Not to the same extent.

2671*. (*Professor Campbell.*) They are sheep farms?—Yes, and are let on lease mostly.

2672. (*Professor Schlich.*) You said in your evidence that one of the reasons why a good many of the woods in Scotland are in an unsatisfactory condition now, has been brought about by the fact that at some previous time they cut out the best trees for pit props to make money. Do I understand you correctly?—That is quite right. I have done it myself.

2673. And you are also of opinion that with proper skill and knowledge in those who have the selection of the crop for certain particular soils and situations, and for the future management of the woods, the ultimate profits would be considerably greater. You also say in your statement that you now find, with very few exceptions, all over the country gappy woods, stunted growth, and short coarse stems standing far apart. For these reasons, you think it essential that greater facilities should be given for education in forestry?—Yes. There are scarcely any facilities in outlying districts. I should say it is essential to give facilities without saying "greater" facilities.

2674. If at a previous period proper facilities had been given, you think this state of affairs would probably not have come about?—Certainly not, or they ought not to, anyhow.

2675. In other words, you recognise the full importance of adequate means of acquiring forestry education?—Yes.

2676. You have yourself now obtained one of the prominent positions amongst Scotch foresters or wood managers; but, I suppose, it has taken you a great many years to arrive there?—Rather!

2677. How many years?—About 25.

2678. If you had had in your youth opportunities freely available for studying a combination of theoretical and practical instruction in forestry, do you think you might have sooner arrived?—A man is better for having had experience in other things besides forestry before he gets a place of trust. He may have the ability, but I do not know that he could exercise the duties of a trust without being well tried in this world first. I do not believe in putting young lads, even with all their knowledge, into places of trust.

2679. I do not want to put a young lad into your place, but I mean to say that the knowledge of forest management which you now possess has taken you a great many years to acquire?—Certainly, and it is not all acquired yet.

2680. Might you not have acquired the same knowledge in a very much shorter time, if you had had proper means of instruction at the beginning?—That is so.

2681. And you also think that improved forestry instruction is required in order to improve the existing foresters?—Yes.

2682. And when you have done that, the extension of forests will come of itself?—Yes.

2683. You will see it by the results?—Yes. Any information we do possess has been only acquired during recent years, and has been mainly due to men like yourself or other writers, who have put the facts before us. In my young days we had nothing to read; there was no literature, and, certainly, no place that we could go to to get an example or see what things should be done. Things are a little altered. The Scottish Arboricultural Society has taught us a great deal.

2684. Did you go to the Continent with that society?—No, I had not the pleasure.

2685. Do you think a young man or a young lad ought to begin practically under a competent manager like yourself?—I think so.

2686. That is the best plan?—Yes.

2687. And then should come further study when he has had some acquaintance with the practical work?—That is so.

2688. (*Colonel Bailey.*) I notice in your memorandum (*Appendix XI.*) that in respect of the general ignorance prevailing, you specify certain matters, for instance, that the forester who has not had any special training does not know the extent of draining necessary, nor the species to grow on various soils, nor at what distances to plant; and he is not even always reliable in valuing timber; he does not understand anything about under planting, nor about the diseases and pests which forests suffer from. Do you find this state of ignorance pretty general?—Yes. It is general everywhere.

2689. And it is due to the fact that there have been no means of acquiring information?—There have been none whatever.

2690. You ascribe some of the very light crops of trees you have on the Scone estate, to the treatment they received?—Yes.

2691. You say it is entirely due to neglect of the plantation?—I have a report on the plantation 80 years ago, and it says that the wood was destroyed for the want of thinning and proper management.

2692. Was it not a fairly common expression a few years ago to speak of any plantation that had not been thinned as having been neglected?—That was so.

2693. When a man said his plantations were neglected, he meant that they had not been thinned?—That they had not been destroyed.

2694. With regard to the cutting down of immature woods when a good price was offered, that is probably largely due to the want of any scheme of management?—It was due entirely to lack of money

Mr. A. Pitcaithley.

25 Apr. 1902.

2695. Do you think the cutting of young woods for pitprops might have been avoided, if there had been a scheme of management?—Yes, I think it might.

2696. I mean if there had been a scheme laying down what the cuttings ought to be at different periods, a scheme of management showing that in each year certain fellings were justified and proper?—It also meant that those who had the management might be ignorant that they were doing any harm to the woods. I mentioned that case to illustrate that I, as a forester, was never questioned as to the necessity of thinning.

2697. (*Professor Schlich.*) There is a well-known highly-placed German forester, the late director of the forest school at Minden, who does it at the present moment, who says that at a certain age you must cut down the best trees. The rest of the German foresters think he is mad?—We have plenty of foresters in Scotland who still advocate the Scotch system.

2698. (*Colonel Bailey.*) It has been suggested that a State area might be obtained for purposes of instruction. Do you think that would also act usefully in informing landed proprietors as to the profits that might be derived from their wood land?—Certainly.

2699. If they could see an object-lesson before them, how the timber could be grown on certain soils and in certain climates, and grown profitably, would this not have a good effect in inducing them to take more interest and care, and spend more money on their woods?—That is the principal effect an experimental forest would have.

2700. Is it not within your knowledge that a great many foresters at the present day hold very diverse views as to the applicability of what we have come to call the Continental systems to our own country?—They are all at sixes and sevens.

2701. Many men say that these systems may be all very well in Germany and France, but they are wholly inapplicable to our country?—Yes.

2702. You say in your statement that there is no chance of settling the disputes and discussions about the application of Continental principles to this country, and no models to which foresters can shape their management?—That is so.

2703. I see you wind up your note by saying that "Under our system we have produced an article of inferior quality that can only be used for certain purposes as a third or fourth rate timber, when, under other treatment, it might excel any foreign timber, and certainly could be produced in greater bulk on less ground than that on which we grow our inferior timber." Do you feel satisfied that we could grow as good timber on our own land as can be imported into the country, if we went the right way about it?—We could grow a better timber than is at present imported. A poorer quality of timber is now imported than formerly.

2704. (*Sir John Rolleston.*) You think there is a good deal of land that would grow timber better than corn or mutton?—Much.

2705. Was it you who said that land which would only make 10s. an acre or less would be better growing timber?—I believe there is plenty of land drawing over 10s., but I should make 10s. a limit. I believe plenty of land drawing over that would be better planted when there is much building and fencing to do.

2706. (*Mr. Marshall.*) I think you mentioned that you would rather advise people to improve some of the badly managed existing woods than go in for planting larger areas?—I mean to improve existing woods as a first step, to be followed later on by other things. If we could show that our woods are better the other would follow as a consequence.

2707. How would you do it—by acquiring certain areas and planting them in the same way? Would you plant young trees amongst old ones?—I do not believe in mixed planting, or rather, underplanting.

2708-9. Would you go in for natural regeneration at all?—With ground game it is impossible.

2710. Do you know the Blackwood at Rannoch?—I have been there.

2711. That is a very badly managed wood?—It is not managed at all.

2712. There are a few very fine specimens of Scotch fir there?—Yes, where the wood was originally dense they are very good.

2713. There is a certain amount of natural regeneration going on there, and there is rather a dense growth of young fir trees coming along in places; have you noticed that?—No; I have not seen anything good there.

2714. I would not for a moment say it is good. We had it in evidence yesterday that most of the young foresters, inexperienced foresters, in Scotland, could be trusted to measure standing timber to get at the cubical contents. Have you found they could be trusted to do that?—Not in my experience. In fact, there are comparatively few old foresters who can be trusted to measure standing timber.

2715. That is what I thought, but we had it given in evidence that it was a common thing for the foresters to value it?—It is done, but I do not know that it is done properly.

2716. You would not say that they measure standing timber accurately?—I do not think they do.

2717. Then you were saying it would not be necessary for young foresters to be instructed in the conversion of timber very much because you thought it was better to sell the timber to the middleman and let it be carried away?—Not always, but in some cases.

2718. In Scone itself do you keep any sawmills?—Yes, for estate purposes.

2719. It would be necessary, then, that the young foresters who were coming along now should know something about that part of it?—Yes. Certainly. Because they may ultimately land in a place where it will be necessary to manufacture timber, and they must have the ability to take that duty upon themselves if required.

2720. (*Chairman.*) I suppose it will be still more rare to get the foresters to tell you what the cubical contents of a certain area of wood is, or whether the amount of wood on the ground is excessive or deficient?—Experience is our only guide now.

2721. But the number of men who can do that is small?—Yes, that is my experience.

2722. Then you say you do not believe in mixed plantations. Is that because they are much more difficult to grow and require much more experience?—The reason I do not believe in them is that I have not yet been persuaded. I have not seen anything to persuade me that it would be judicious. I am referring to the underplanting of these plantations. When a plantation gets to be over-thinned, I think it is best to clear it out.

2723. I mean by mixed plantations different varieties that happen to grow well together—mixed trees in a plantation. You may have several varieties of trees growing together in the same piece of ground. Would you object to that system?—Certainly not. It is sometimes necessary, but to what extent we do not know.

2724. We have had it in evidence that coniferous wood is what there is the greatest shortage of. Do you find coniferous woods do very well in your country?—Excellently.

2725. If woods could be mortgaged, and a regular system of felling formed part of the schedule to the deed of borrowing, it would be impossible in that case to cut woods before the time at which it was arranged to do it?—It would.

2726. If you could mortgage the growing timber, and you had a plan of regular fellings attached to the deed or mortgage, you think that would get over the difficulty?—Yes.

Mr J. H. Croxford.

Mr. JOHN H. CROXFORD (Messrs. Price, Walker, and Company, Limited, Timber Merchants, Gloucester), called; and Examined.

2727. (*Chairman.*) You are a member of a large firm of timber merchants in the West of England?—Yes.

2728. No doubt you find your west country is very favourable for the growth of trees?—I am very little in touch with English timber, but, of course, in Gloucestershire there is a comparatively large area of English timber grown.

2729. You chiefly import?—We import very largely.

2730. Do you find that for most purposes foreign grown timber is better suited for your needs than the home grown?—English timber cannot compete in quality or in price with the great bulk of the wood used in building construction in this country.

2731. You will agree, as we have already had it in evidence, that for some purposes, where you want exceptional durability in the timber, the British is better than the foreign?—English oak is far superior to any foreign oak, and the same may be said of ash, beech, and elm.

2732. But, as you say, none of these are grown in sufficient quantity to supply the needs of the home market?—No, it is impossible.

2733. Do you think the irregularity of the supply of British timber depreciates its value?—I do not handle English timber. I handle foreign timber, and at no time have I found, for many purposes, that English timber, as at present produced, can compete in price against foreign.

2734. You fear, do you not, that there may be a falling off in the supply of foreign timber?—The day will come within a reasonable time when foreign timber of some classes will get more expensive than English timber.

2735. Do you find any falling off in the quality of foreign timber?—No. There is some class of foreign wood that is getting more expensive every year, costing more for production. Thus, I think for many purposes English timber will supplant foreign, and also that English oak, ash, and elm will be used, seeing that it will compete in price within a reasonable time.

2736. Is there any falling off in the home demand for timber?—No, it is greater than ever.

2737. Is the price gradually rising?—The price of foreign timber is gradually rising.

2738. But you get every kind of it with facility?—Yes, readily. I heard you gentlemen talking about English larch and spruce being a cheap timber. I can import Canadian spruce cut to sizes for 1s. a cubic foot, and there is no English timber at the present moment that can compete with it. One very great bar to English timber, larch, Scotch, and so on, for pitwood is the heavy railway carriage. You asked the last witness how it compared. Our foreign timber is carried at very much smaller rates than English timber. It is handled easier. But apart from that, the railway carriage from the port inland is very much less than from one place to another for English timber.

2739 Do you import the bulk of your timber in the round?—No; when it is in the log timber it is dressed!

2740. Have you mills of your own?—We have.

2741. Do you think our English mills are as a rule up-to-date?—We think so. They are being improved to keep up with the times.

2742. Is all the latest labour-saving machinery being used?—Yes.

2743. And is the practice of bringing in manufactured wood increasing as compared with bringing in timber in the round?—Yes.

2744. But you think it will be possible to have a great extension of the home timber supply if it is properly managed?—Undoubtedly, more especially with slow growing woods.

2745. Do you import larch?—No, but we import timber that competes with larch; for instance, the Canadian spruce, which is far cheaper than larch. Larch is used for pit-wood chiefly, fencing, and that class of work. We import spruce as against larch for fencing and such things. Norwegian and French pitwood, a small Swedish timber roughly dressed, cut to lengths, as against larch grown here. Unless larch is near a colliery, larch cannot go against imported stuff.

2746. Have the two been tested together?—I am speaking about cost.

2747. Do you think that the purchasers in this country understand the value of wood? They do not mind that. It is the question of cost in these times.

2748. Is it purely a question of cost?—It is purely a question of cost.

2749. Do not they take into the question the durability or seasoning?—Not at all.

Mr. J. H. Croxford.

25 Apr. 1902.

2750. Do you think that most of the wood that is used in this country is properly seasoned, the home and the foreign?—A great deal of it; but, of course, with foreign wood a great deal of it is artificially seasoned. We have a large drying plant.

2751. (*Mr. Marshall.*) I should like to ask about these railroads. We have already had some evidence with regard to it. Is it a fact that the rate for foreign timber from Gloucester to Birmingham is only 6s. per ton, 66 feet to the ton?—That is right.

2752. Whereas the price of English round timber, 40 to 50 feet to the ton is 11s.?—I think that is so.

2753. How do you account for the railway company giving such enormous preference to the foreign import? Foreign timber can be put on the trucks alongside the wharf with light terminal charges. The timber is put up in train loads and taken away to its destination, whereas the English has to come to the station, and there are heavy terminal charges. A few trucks are only picked up at each station at one time and another.

2754. It is more easily loaded, that is to say, of a better shape and size to get on to a truck?—Yes, and the terminal charges are very considerably less.

2755. We have had it in evidence that the quality of foreign timber that comes into this country is not as good as it used to be; in fact, we are told that some special sort of deals were almost unprocurable. Has that been your experience?—There is much less of Ottawa pine deals, certainly? but I have never seen the time that they could not be obtained at a price.

2756. The price of the best quality of foreign stuff has gone up considerably?—Yes, of all sorts.

2757. Have you visited any of these forests at all where pit-wood comes from?—I have not.

2758. Is it all young wood?—Yes.

2759. This enormous quantity being drawn from these woods must more or less damage the future timber supplies?—Yes.

2760. (*Professor Schlich.*) What kind of timber do you import chiefly?—We import chiefly Norwegian, Swedish, Finnish, Russian, Canadian, and from the Southern States of America.

2761. Do you import large timber or pit-timber chiefly?—We import neither, but I am closely connected with people who do. We import spruce. There is not enough in pit-timber.

2762. Is it imported squared?—French timber is round, cut into lengths ready to put into the pits. Norwegian is dressed, roughly squared, and cut to longish lengths.

2763. Those are all pieces of timber of comparatively small dimensions?—Yes. What we should call all sizes.

2764. Do you import timber of larger sizes for planks?—Yes. We import both timbers and deals, boards, match boards, and all those things. They are all dressed.

2765. Do you get some of the larger size timbers from the country round the Baltic, Norway, Russia, Sweden?—We import Swedish timber, but the great import from the Baltic is converted timber, deals and boards.

2766. How many years have you been at the work?—Since I left school, 34 or 35 years ago.

2767. I was going to ask you whether you had noticed that there has been a falling off in the dimensions of these big logs?—I have not. I think that the reason of the cost being gradually enhanced is that much of the timber is being cut further away now from the ports.

2768. You have not noticed any particular falling off in the size of the log?—I have not.

2769. Do you sometimes get white pine from Canada?—Yes.

2770. It has been officially stated that the dimensions of the logs exported from Canada have considerably fallen off in diameter?—I think that is correct.

2771. There is a considerable falling off in the size of the logs of white pine?—Yes, I do not think the word considerable should be used—there has been a falling off, but not to any very great extent.

2772. (*Colonel Bailey.*) I should like to make a remark in this connection. Three or four years ago I passed through a good part of Canada, and went into a great many forests in which they were cutting the

Mr. J. H. Croxford.

25 Apr. 1902.

white pine. I was in the company of people who knew all about the past history of these woods, and I saw the whole thing in actual operation. There is no doubt in my mind that woods had been passed through before, when timber of certain large sizes were cut out, which alone were then considered worth taking. Now there is a new development. There have been concessions or grants to timber merchants, who now go and take out the timber which was neglected by the former grantees, who did not find it worth their while to remove it?—That is so. But there is a great quantity of timber of large dimensions further afield.

2773. (*Chairman.*) You are quite satisfied with the manner in which the foreign producer, saw miller, or manufacturer, puts his goods upon the market here?—Yes.

2774. He does it well?—He does it very well.

2775. Do you think that he knows his business better than the home people?—That is my impression. My partner, who is a landowner in the neighbourhood of Gloucester, has been replanting, and he has stopped, for the reason that the local authorities have assessed his plantations, land which was not worth 2s. 6d. an acre before it was planted at 10s. an acre. That holds good through Gloucestershire. Land which he could not let at all is assessed at 10s. per acre, besides coming under the agricultural rates of 1s. 3d.

2776. (*Professor Schlich.*) Because he has planted it?—Yes, and spent money on it. Why I should be glad to see afforestation is that we locally get very short of labour in the summer time, and if large plantings were carried out, the labour that would be used in the winter and spring would be available for us in the towns in summer. Country labour is very cheap with us.

2777. So that in your partner's case the rates have actually stopped the extension of the area?—Yes.

2778. Have you ever heard of the tithe being heavy on land?—He has no tithe on the land. I do not know anything about the tithe.

2779. (*Mr. Marshall.*) They are not encouraging him at all?—No. He told me that they assessed him at 10s. an acre on land not worth 2s. 6d. an acre.

2780. (*Chairman.*) You think that although you can get all you want now, there is a possibility of a timber famine ahead, and we ought to be preparing for it?—Undoubtedly.

2781. Both in coniferous and hard wood alike?—Undoubtedly. I know a great many English timber merchants, and generally see a great many. There is a lot of felling going on, and very little planting, especially with the slower growth trees, ash, oak, elm, and beech. I am told that you cannot grow good timber from old stools.

FIFTH DAY.

Tuesday, 6th May, 1902.

PRESENT:

Mr. MUNRO-FERGUSON, M.P. (*Chairman*).

Sir JOHN F. ROLLESTON, M.P.
Mr. E. STAFFORD HOWARD, C.B.
Professor W. SCHLICH, C.I.E., F.R.S.
Colonel F. BAILEY, R.E.

Professor J. R. CAMPBELL.
Mr. J. H. LEWIS, M.P.
Mr. GEORGE MARSHALL.
Dr. WILLIAM SOMERVILLE.

Mr. REGINALD H. HOOKER, *Secretary*.

COLONEL BAILEY, recalled; and Examined.

Colonel Bailey.

6 May 1902.

2782 (*Chairman.*) In the evidence that we have had it has been frequently recorded that there is an absence of figures or systems of accounts which would show whether woodlands really pay. Is there any difficulty in instituting a system of control books which will show the revenue and expenditure, and therefore prove what the land is actually giving under timber?—Such returns are commonly kept up for State forests in France and Germany, and doubtless in other countries. I consider such statements and accounts are absolutely necessary, not only in order that you may have a record of the expenses and receipts to show what the woods have actually earned for you, but also to keep the records of work done for the benefit of those who come after you, and who have to revise any plan under which you may be working; also for the further purpose of securing and showing the owner that the provisions of the working plan are being carried out, and that the cuttings prescribed in the plan are duly executed. This is a very important point, because if you have no control of cuttings there is no use whatever in laying down the plan. You must be able to see they are properly executed. Hence it is quite the usual thing in all organised woods to have such records.

2783. There has been a general concurrence of opinion in favour of regular systems of working woods by working plans, and you think that these control books are an essential feature of that system?—Essential.

2784. And it is almost the universal custom abroad?—So far as I am aware, it is a universal custom in all organised woods. It is the only way of maintaining the organisation.

2785. When you commenced to deal with forestry in this country did you find an absence of any system of keeping accounts?—I found no system existing; so that although one may get isolated statements of a certain value no doubt, it is impossible to get any accurate statements that can be relied upon to show fully what occurred in the past.

2786. You put a system of accounts into operation. Have you heard that there has been any difficulty, or have you found any difficulty in having it carried out?—I have not heard of any difficulty at all. On the other hand, I have heard it has been found quite easy. If you desire it I will explain what the system is. In a working plan I made some years ago I laid down the general scheme under a plan of management, and then I prescribed the location of the fellings, for a period of 20 years. The table shows the fellings of the first year, the second year, the third year, the fourth year, etc., down to the twentieth year; and it shows the areas in which these fellings were to take place. Then it was necessary that the proprietor of the estate should know whether this work was being done or not. Hence we adopted—I will not say devised, because the form is an old one—a form which shows in the first place the provisions of the working plan—that is to say, it gives an abstract of the prescriptions of the plan in regard to each year. You find under the plan, for instance, that in the fourth year, 1901-2, cuttings are to be made in five different blocks. It is the duty of the forester or of the factor to put this down in the first column of the form. At the end of the year he fills up another column which shows what was actually done. Then a comparison is made between the provisions of the plan and what was actually done, and you may get an excess or deficit of cutting. If you have not cut one of the perscribed areas it remains a deficit. If you have cut more than was prescribed that would appear as an ex

Colonel Bailey.

6 May 1902.

cess. According to the principles on which we work in organised woods you are entitled in the next year, or any year you like, to take out any deficit of cuttings that may stand to your credit; but, on the other hand, if you have cut in excess, which you might possibly have had to do, that excess has to be adjusted as soon as possible by reduced fellings. The proprietor can see at any moment from an inspection of this book to what extent the provisions of the plan as regards cuttings have been carried out. He knows at any moment exactly how he stands. This plan prescribes the cuttings in detail for a period of 20 years, which is perhaps an unusually long one. There may be always a slight divergency from the prescription to suit convenience. Something might happen which would lead you to cut an area sooner than was laid down in the plan. For example, supposing you experienced a storm that blew down a portion of the crop, you might say, "If I do not take the rest next year it will be all blown down." That would lead you to modify the provisions of the plan. If you had to take one area before its time, you must take another later than its time, in order that you may not exceed on the one hand or cut too little on the other. This book clearly shows you how the matter stands. As regards the rest of the records, we have here a cash book of the kind that would be kept upon any estate, or, indeed, in any business, which simply shows the cash transactions from day to day. The cash transactions are ledgered out into another book, so that under each heading of work and for each forest you find exactly what has been done, what cash has been received, and what has been expended, and under what heads. Then we have we have a further form in the same volume which gives a summary of the whole work. It gives you in the first column, "Site and Description of Work," the result of the cuttings—that is the quantities of timber cut in each year, and a summary of all the other works performed, such as so many chains of fencing, so many chains of drains, etc.; and there are two columns at the end which show the money value of the produce disposed of, and the cost of the work; so that here, within the covers of this book, you can see in one moment that your cuttings are kept within the limits prescribed by the plan, and, on the other hand, you can see at a glance what the financial result of the work has been. A book like this is quite easily kept up, and a volume of this size would last a great many years. You have a complete record of the forests on the estate, and you can see exactly what the financial results of working have been.

2787. (*Mr. Stafford Howard.*) I should like just to have your ideas, which I understand you have formed pretty accurately, as to what is ideally desirable for the instruction forest in Scotland in connection with the work that is now being carried on in forestry instruction in Edinburgh. I should just like to know what you think is desirable from your point of view, if it could be got?—You refer, I understand, to an instruction forest, what Dr. Schlich has called a school forest?

2788. Yes, exactly so, or a State model forest, if you like?—I have explained that in the memorandum which I read at the beginning of my evidence, but I shall have great pleasure in repeating it. I am quite sure that it is wholly impossible to carry on instruction in forestry without an area for the practical illustration of what you teach. That is an absolute impossibility; you cannot do it. There are some things, no doubt, you can teach in part to students by word of mouth or diagram, but most of the instruction cannot be given effectively in that way. You cannot possibly give students any sort of idea on the subject of thinnings, for example. You might lecture them for session after session, and then send them into a wood to carry out the work, and I am quite certain they would not have the slightest idea how to begin it. Such teaching must be practically demonstrated, and consequently all teaching of forestry without an area for practical instruction is ineffectual. Therefore I affirm that we must have an area for practical instruction. But I must go a step further. That area must be properly managed. It is little use taking students to teach them sylviculture in a wood in which sylviculture is not properly carried out. One may take a class to a wood and say, this thinning has been done wrongly; the stock is much too thin, or this or that error has been made. That may be of some use, but still it does not tell them how the work ought to have been done.

2789. What sort of area do you think would be necessary?—I feel a considerable difficulty in stating an area, because this would so much depend upon the conditions of the ground. If it could show varied conditions of low ground, high ground, and so on, then its area should be larger than if it could illustrate one particular kind of work only. I think the ideal thing would be to have a large area with very varied conditions within it. I should say, speaking generally, perhaps we ought to have areas of 1,000 to 1,500 acres.

2790. That would be sufficient to occupy the time?—I should think it would. I would like then to have an instruction forest or school forest, of somewhere about that area, more if we could get it, sufficiently near to Edinburgh to enable the students to go there and back in the day, so that they could make a day's excursion, starting as early as you like in the morning, and coming back at night. I do not think it is necessary that the forest need be within half an hour or an hour of the town, but it should be sufficiently near to enable the class to go there and back in a day.

2791. Is it your idea that the forest should be under the management of the instructor in Edinburgh with a local forester on the spot to carry out the practical work? That the direction of the whole should be in the hands of the Forestry School in Edinburgh?—It is most desirable that the professor or lecturer in Edinburgh should have control over the work. I have seen school forests attached to several continental forest schools, and in all the cases I know the director of the school has complete control over them. That is done to prevent clashing, and to make sure that all work in the woods is done not only in the most economic and best way from the professional point of view, but also that the woods are made as useful as possible for the purpose of instruction. It is within my own experience that friction may otherwise arise, because the professor of forestry at the forest school would take his students to criticise the work of someone else. He is bound to tell the students where the work is well done or badly done, and criticise it. If he goes to woods which are under some other management than his own, and over which he has no control, that is very apt to lead to friction, and I believe that the only way in which this can be entirely avoided and the work done in the most convenient way for the purpose of instruction is to allow the head of the forest school to have control; he must have a thoroughly qualified man in the forest, who can carry out the work, but he must tell the man in charge what he wants to show, and ask him to undertake such and such works for the purpose of illustrating the class work.

2792. You would say, I suppose, that such a forest ought to be managed not merely for the sake of instruction, but also to pay financially?—It might be managed very well to pay financially. If it could not be managed to pay financially it would not be a forest of instruction. That is the first condition I would put down, that it is to be managed essentially for profit. One of the essentials is that it should show a good financial result. I would go so far as to say that if it was not managed in that way it would be of no use at all for practical instruction in economic forestry.

2793. The selection of such an area would require considerable care?—No doubt.

2794. But you think such an area might be acquired?—I think so.

2795. There are areas available which might be suitable?—I cannot speak at the present moment as to any particular area, but from what I have heard, I think that suitable areas might be found.

2796. (*Professor Campbell.*) You are distinctly of opinion that this model forest should be worked to be a commercial success?—Absolutely so.

2797. And that at the same time it would be perfectly suitable as a demonstration?—Yes. I repeat, if it were not managed on commercial principles it would not be a suitable demonstration forest.

2798. You could not demonstrate methods that are to be avoided or the growth of trees which might not be particularly suited for the district, and yet it would be necessary to show your students the cultivation of such trees?—If you want to show them that, there is no difficulty in finding it round about, and this will be so for some time to come. I do not think it would be necessary to make provision to show bad work. A school forest or instruction forest would certainly em-

Colonel Bailey.
—
6 May 1902.

brace an area for experiments. That would be a legitimate part of the working of the forest as a financial concern, because you want to do the very best that you can, and to do it a certain amount of experiment is necessary.

2799. In your replies, have you been keeping the idea of the forest school quite distinct from the model forest?—No, it is one and the same thing. My idea is that if you have a forest primarily for educational purposes, worked on a financial basis entirely, it would also act as an object lesson to proprietors and foresters and others interested in the business, who would come to see it, and to learn what it was possible to do under certain systems of management on our soil and in our climate.

2800. But what if that soil was not suitable to the kind of tree you wanted to grow?—That would point to having more than one area.

2801. So that in that case you would require to have more than one area?—I think you would.

2802. In fact, you would require to have the use of forests that were badly managed as well. That would be useful, would it not?—If you wanted to show work not done in the best way there would be no difficulty in making visits to such woods. You need not have any control over them. It is very easy to get a permission of proprietors to see woods managed on the old system.

2803. I ask the question because to say that the woods ought to be worked at a profit would perhaps to some extent handicap the teaching. Personally I would not like to advocate that the woods ought to pay?—I quite see that. I have said that, although the woods should be managed on economic principles, you would have an area for experiments. That particular spot of ground would, of course, not be managed for profit, although the forest as a whole would be so managed.

2804. You made reference to model forests or forest schools in other countries. As a rule do you find that the College, or the place where the class-room instruction is given, is quite near the forest, or do you know of cases where there is a considerable distance between them?—It is very seldom that you get forests very near class-rooms. I ought to remember very clearly the distance of the Forêt de Haie from Nancy School, and to the best of my recollection it is five or six miles.

2805. You would have them within an easy day's journey?—Yes; you cannot get forests at the door of the classroom.

2806. But you could take the class-room to the forest?—Yes, you could, and you would do so, under the scheme I have suggested for practical foresters.

2807. But not for the training of landowners and agents?—No; and simply for this reason—that the cost of a separate forest school for them would be so very high. You would have to provide separate professors and a separate establishment entirely, with students' houses, professors' houses, and everything else; whereas if you establish yourselves at a university you find a great deal already provided. I have always thought that some day or other we might have a separate forest school of that kind; that a demand for it might arise when the proprietors generally, having realised the value of the property they hold, were willing to pay much higher salaries than they do now for the management of their woods. Then it would be worth while for head foresters to come to get a superior education at the university. I quite look forward to that some day or other, but we have to deal with existing facts at the present time. Students of that class would not now attend the university.

2808. With reference to the interesting information you have given us with regard to plans and accounts, you say there are no returns, or very few returns, kept in Scotland, and very little hope of getting at the actual income from the woods in Scotland?—I should think so.

2809. Do you think it is due to any real difficulty or to a lack of interest?—There is no real difficulty at all. I think it is due to the fact that the woods have not been managed on business principles.

2810. There is a lack of interest?—A lack of interest.

2811. Would there be a considerable difficulty now in setting about drawing out plans for a large number of the woods in Scotland owing to the fact that they have been hitherto so irregularly managed? Supposing the owners were induced to go in for plans and books, would not they find a considerable number of obstacles at the beginning which would require a great deal of perseverance to overcome, and would not they require expert advice, in fact, to obtain a number of forestry inspectors?—I should like you to ask that question again.

2812. The first point was this: do not you think there will be a considerable difficulty now if you go into Scotland and draw up plans for existing woods owing to the fact that they have been irregularly managed?—I do not think so at all. The condition in which the woods are now has nothing in the world to do with difficulties in the plan. You have the woods before you; the problem is what you are to do. The worse they are the more necessary is the plan. If you had an estate thoroughly well managed, you might say it did not want anything; that might be said. I do not admit it would be right myself. The worse managed the property is, the more necessary it is to take it up in a regular way.

2813. You would require to make sweeping changes if you are going to set these woods in order now?—What do you mean by sweeping changes?

2814. For example, if you wanted to map out your area into definite rotations, would it not require sweeping changes in certain parts of the forest; would not you have to sacrifice trees half grown?—Nothing of the kind; absolutely not.

2815. We have been told that the woods are very thin?—I think if you will allow me I could give you in a very few words the sketch of the working plan I hold in my hand, if you think it worth while.

2816. (*Chairman.*) I was going to ask whether Colonel Bailey would not hand in the sheet of the working plan, and then the actual thing would be an appendix?—I should be very glad.

2817. You have the sheet printed—the form printed—that you recommend?—Yes, but Professor Campbell is on another point.

2818. (*Professor Campbell.*) I am asking about the plan, and perhaps the plan itself will be put in?—I understand you have asked me whether in the existing state of the woods it would not be difficult to frame a plan, and whether in order to carry out a plan great sacrifices would have to be made of young trees. My answer is, not at all. The problem before you is simply this: you first of all acquaint yourself with the actual condition of the woods, and then you have to say what is the best thing to do under the circumstances. That does not involve sacrifice. You must do the best thing without making a sacrifice.

2819. Do not you think that there would be a demand, supposing that landowners realised the importance of making these plans, for forestry inspectors to assist in preparing plans, that is, if any active operations were to be undertaken in the near future?—In my opinion a plan such as we are speaking about should be made by a forest expert, not necessarily an inspector.

2820. I use the word "inspector" in that sense; so that there is a need for a school for the training of such men, is there not?—Yes.

2821. (*Mr. Marshall.*) You have said that the necessary area for a State model forest would be 1,500 acres or more, if you could get it, and that depends entirely upon the nature of the land that you acquire, whether you have a certain portion on hill side, a certain portion facing different points of the compass, and a certain quantity of low land. Would it be essential to this scheme to have this land with some sort of forest or some sort of planting wood on it?—I think it would be most desirable. We should view with great disfavour a piece of bare land; it would take so long before you could show anything.

2822. It would take a long time before there would be anything to show or anything to instruct from?—Yes.

2823. (*Dr. Somerville.*) You place great weight, of course, on a proper system of forestry book-keeping?—Yes.

2824. I suppose you would define the various charges under different heads, would you not?—Yes.

2825. I suppose that a well-conceived plan of book-keeping prevails in the State forests of India?—Yes.

2826. Would it be competent for you to hand in to the Committee the form that is used in India for the keeping of the records of the results of forestry?—I feel quite sure I could obtain permission for that. I do not think there is any difficulty at all.

2827. (*Chairman.*) I suppose, Colonel Bailey, you

Colonel Bailey.

6 May 1902.

would say, although there was no difficulty in making a plan, it needs considerable technical skill in order to do it?—Yes. I understood the question to imply that you would have to make so many changes and so many sacrifices that you might do more harm than good. Certainly, in my opinion, to make a proper working plan you require an expert.

2828. With regard to the 1,000 or 1,500 acres which you consider a sufficient area, the least area that should be available for instruction in forestry, you include in that land planted as well as land to be planted?—Land stocked with trees now.

2829. Partially stocked with trees now, and partially unstocked; or do you mean that you want 1,000 or 1,500 acres of wood?—It would be very much better to have the 1,000 or 1,500 acres already stocked; the more stock you have on the ground the better.

2830. But you may not be able to demonstrate if you had 1,000 or 1,500 acres?—I think so. What I mean with reference to Mr. Marshall's question is this. Suppose you have a flat piece of ground with the same kind of soil throughout; you could only keep repeating the same thing on it, whereas if you had a tract with various elevations, some rising to 1,500 or 2,000 feet, and some low-lying ground, you could have a different series of operations in each particular part. You might have conifers in the higher ground; oaks, ashes, beeches, and other hard wood trees lower down. To enable you to show many different crops a large area would be necessary. But then if you had it, this would save your having some other area elsewhere.

Mr. JOHN T. MAXWELL (Scottish Local Government Board), called; and Examined.

Mr. J. T. Maxwell.

2831. (*Chairman.*) You belong to the Scottish Local Government Board?—I do.

2832. You have given us an interesting statement (*Appendix XII.*) on the valuation of woodlands on which I will ask you one or two questions. Have you any official definition of woodlands?—I have no official definition of woodlands. In the statement which I have prepared I have dealt with ground under wood, whether as plantation or as woodland, which has been grown for the purpose of cutting.

2833. Ground under wood may appear, I suppose, as shooting, or grazing, or as woodland?—It may appear as shooting, woodland, or, in some instances, as grazing. It does so in the valuation rolls. The valuation roll may contain an entry of an estate as a woodland or as a plantation. I cannot say what distinction the assessors draw between woodland and plantation. I am not aware of what the strict definition is.

2834. The same area of land covered more or less with trees might be put under three separate heads of grazing, or shooting, or woodland in the valuation roll?—I would rather not answer that question. I do not feel quite in a position to do so. It might depend to some extent upon the individual assessing.

2835. There is no official definition to guide the assessor in classing a piece of woodland as plantation or as grazing or as shooting?—I am not aware of that.

2836. Woodlands which are grazed and shot over are rated at their grazing and shooting values?—Yes, on both.

2837. Therefore mature wood in a plantation which was grazed would be itself unrated?—Mature wood which was grazed?

2838. Mature timber in a grazed plantation which might be worth possibly a good deal of money would not be rated: merely the grazing would be rated?—The grazing value would be rated, not the actual value of the mature wood. That is perhaps the only exception to the general law of valuing in Scotland. Subjects in Scotland are valued as nearly as possible at their actual value—that is to say, the rent they bring, or, if unlet, the rent which the assessor considers would be a fair and equitable rent for the subject. Twenty years after planting a wood is, of course, much more valuable than it was when first planted; but still the value put upon it by the assessor twenty years after planting, or thirty years after planting, is exactly the same—the grazing value—as it was the first year of planting.

2839. On the other hand, wood, we will say, fifteen or twenty years old, which could not be grazed and was worth nothing, is rated at its full grazing annual value?—Yes. What the assessors do is to take the ground as if there were no wood upon it at all, and rate it at what it would bring in for grazing value—supposing there were no wood upon it.

2840. The wood itself, therefore, as a subject pays rates whilst it is worth nothing, and pays no rates when it becomes mature?—No. That was settled by a case in Court.

2841. It might be then worth a good deal?—That is so.

2842. The wood when it is worth nothing as wood has to pay rates because a grazing value is charged when no grazing could be carried on. When it is matured, possibly with a good deal of money, and the wood is grazed, the grazing pays the rates, but the wood pays nothing?—That is so.

2843. Have you had any complaints in regard to the system of local taxation of woodland?—The Local Government Board, so far as I am aware, have had no complaints.

2844. Has your attention been drawn to the recent report on the incidence of local taxation in Scotland?—By the Royal Commission on Local Taxation?

2845. Yes?—I have read that report.

2846. It does not contain any reference to the woodlands?—Not any special reference, I think.

2847. It makes no change?—I think not.

2848. In dealing with the improvements of local rates you describe very clearly the incidence of taxation as applied by the Parish Councils. You said 10 per cent. is possibly being given off land; 20 per cent. off houses, and 33 per cent. or even more off railways. In some cases the deductions are much larger than those figures, are they not? In the case of the Highland line, for example, it is only paying rates on buildings?—That is not exactly because of large deductions, but because of the method of valuation. The railway valuation is made by the assessor of railways, and he has a special method, according to the profits, I understand. It is because a value is not entered on the valuation roll. It is not because of very large deductions, but because of the railway assessor's value of the subject.

2849. I mentioned the point to show that these deductions, however they are made, involve heavier rates on other subjects?—Clearly.

2850. You say that in 799 parishes, agricultural subjects are rated upon three-eighths of the annual value, but that woodlands are rated on the full annual value?—That is so. Woodlands are universally excluded, as I said, from the term "agricultural land and heritage."

2851. Having had no complaints, you have not heard any expressions of opinion as to whether that is generally regarded as an equitable arrangement?—No, I have heard no expression of opinion.

2852. Again, on the subject of deductions, where the agricultural rate is insufficient to meet the five-eighths to agricultural occupiers, the parish would have to raise a rate to meet any such deficiency?—Yes. The occupiers would have to raise that rate.

2853. The occupiers would have to raise that rate?—I am speaking of parish rates only just now. There is a distinction with regard to county rates.

2854. Would part of the additional burden required to make good that deficiency be for the woodland?—Yes. If you will allow me I will state very briefly the method by which that deficiency where it exists is raised. Suppose a parish has to produce £500 of assessment, £250 of that amount would be raised from owners by an uniform rate. The other £250, less the amount of agricultural rates grant, would be raised from occupiers upon the occupiers' assessable rental, agricultural subjects being rated upon three-eighths only. Now, if the amount of the agricultural rates grant did not equal the amount of the five-eighths relief to agricultural occupiers, the deficiency would have to be spread over the whole of the occupiers. That is, a higher rate would fall upon occupiers than upon owners to make good that deficiency. Thus, in a parish the rate upon owners might be sixpence and the rate upon occupiers might be sevenpence, or even eightpence, ninepence, or tenpence per £, depending entirely upon the amount of

Mr. J. T. Maxwell.

6 May 1902.

deficiency and the value of agricultural land which was relieved of the five-eighths of its rental.

2855. But all woodlands would be rated to make up any deficiency, to meet the deduction of five-eighths?—That is so, woodlands among other subjects.

2856. You say that woodlands are rated upon the full gross rental. Is it not rather on the full net rental?—In county rates upon the full gross rental; in parish rates upon the gross rental under deductions mentioned in the 37th Section of the Poor Law Act. Parish rates are levied on the net annual value; county rates are levied on the gross, as appearing in the valuation roll.

2857. But the county rates would be levied on the unimproved pastoral value of the land under timber?—Yes.

2858. To get the rent of that you would deduct the cost, if it was part of a sheep farm, of the shepherds; therefore it would be the full net rental?—All the county rates are levied upon the value in the assessor's roll. It is for him to determine what shall come off.

2859. Woodlands, so far as the incidence of the rating is concerned, are more heavily rated than agricultural land. They have no deduction under the Agricultural Relief Act?—In the great majority——

2860. They are liable to make good any deficiency under that Act?—That is so. We would have to limit that however to those parishes which have no classification of occupants for rating purposes. In county rating woodlands always pay upon the full rental. In certain classified parishes, however, woodlands are rather more favourably treated. Indeed, in a number they are treated as favourably as agricultural land. In these parishes, of course, they are not worse off with regard to rates than agricultural land.

2861. That is a very small percentage of parishes in Scotland where they do receive any favourable treatment?—Very small indeed. I have an example here.

2862. I think you have given them in your statement?—Yes.

2863. (*Dr. Somerville.*) I suppose there are cases in Scotland where the woodlands are handed over to the agricultural tenant to work for his own advantage?—I have had no experience in these matters, and cannot answer that.

2864. You are not prepared to speak of the English system?—No. I can only speak to the rating of the Scottish system. I am not up in the English system.

2865. I suppose then that the general principle that guides the rating of woodlands in Scotland is that an assumption is made that the return to the owner, when his land is planted, shall be just the same as the return when the land was under pasture?—Yes.

2866. And if land unusually suitable for forestry is utilised, then the rating on the owner will be relatively very favourable, but if the land that is very unsuitable for planting is put under wood, then the owner, I suppose, will suffer somewhat?—That would follow naturally.

2867. This then places, as it were, a premium upon good selection for the purpose of forestry?—Yes.

2868. I suppose that in the case of woodlands it is the unimproved pastoral value that is taken as the basis?—It is practically the value of the ground before it was planted.

2869. Unimproved?—Unimproved. The term of the Act is in its "natural state." "Where lands and heritages consist of woods, copse, or underwood, the yearly value of the same shall be taken to be the rent at which such lands and heritages might in their natural state be reasonably expected to let from year to year as pasture or grazing lands."

2870. Supposing in a case a landlord has a field of 20 acres which is under grass and is let only at £20 a year, and he makes up his mind he will put those 20 acres under trees, would the rateable value remain at £20 a year?—Yes.

2871. But still the grass field before it was put under trees may have been drained, limed, and manured, and improved in a great many ways, to bring it up to the pastoral value of £1 an acre, and the £1 an acre is no longer the value of unimproved land, but is the value of highly improved land. So that I suppose the woodland rate subsequently would remain as it were on highly improved land, and not on land in its natural state?—I should say that would be a question for the assessor to settle when fixing the value.

2872. In other words, we must not, I suppose, take this term unimproved or natural condition as being invariable, because this same land which as a grazing field was worth £1 an acre may in its natural and unimproved condition be worth only 2s. 6d. an acre?—I am sorry I cannot speak from that point of view.

2873. We have already had before us the case of an area of comparatively matured woodland which is used for the purpose of grazing, and assuming that the unimproved value of this land is 2s. 6d. an acre, and further assuming that when the comparatively matured wood is pastured by sheep it is let for 2s. 6d. an acre, then it has been said that the trees on this area escape taxation. Apparently the wood escapes taxation, does it not, if the land is let for 2s. 6d. as grazing land, and it is carrying a stock of timber worth £20 or £30 an acre; then this timber is not being assessed?—It is not being assessed if the land is worth for grazing purposes as much with the timber upon it as it would be if there was no timber there.

2874. There are, I believe, plenty of cases where a certain amount of timber on the land does not interfere with the pastoral value?—Yes.

2875. But, as a matter of fact, is it not the case that the timber after all has not escaped, because during the 30, 40, or 50 years, when the wood was enclosed, and no sheep were on it, the land then was assessed also at its unimproved pastoral value, and yet was returning no income at all to the landlord because it was not being grazed? Is it, therefore, not a fact that after the wood is thrown open to grazing it is then, as it were, bearing the rate which had been put on before it was opened?—I do not quite follow that question.

2876. I will just take a specific example. We have an area of ground which in its unimproved condition is worth 2s. 6d. an acre. This area of ground is planted with trees, and during the first 40 years no stock are allowed into the wood, and, therefore, the return to the owner, if any, comes from timber and the shooting. He at that time is assessed on a basis of 2s. 6d. an acre. After 40 years we will assume that the wood is thrown open to stock, and it may be to grazing, and is let, we will assume, at 2s. 6d. an acre. Now from the fortieth year onwards the landlord is really getting 2s. 6d. an acre from the grazing of this particular wood; but the area would be carrying timber worth £40 or £50 an acre, and that timber appears to be escaping assessment because the landlord is paying only on the 2s. 6d. he is getting from the pastoral tenant. I want to know if you agree with me that although the timber appears to be escaping assessment it has been really paying rates during the first 40 years when the landlord was receiving no pastoral rent?—Clearly.

2877. Therefore, I think, although it may perhaps appear to be the case that woods which are grazed are escaping assessment so far as timber is concerned, that that timber has already, during the time the wood was enclosed, paid its fair share of rates and other things?—Yes, in the example you have just mentioned.

2878. (*Chairman.*) In your experience have you found that the practice of assessors differs very widely or differs at all in different counties in fixing the rates which woodlands should pay?—I cannot say I have. Of course there will be differences, but I think on the whole they are not great. The Inland Revenue officers, who are the assessors in 24 out of 33 counties, should at any rate act upon the same principle.

2879. They are assessors for the Inland Revenue Office?—Yes, they are also local assessors in these cases.

2880. What is the local assessor usually by profession; is he a land valuer?—Sometimes he is a solicitor. Twenty-four out of the 33 county assessors are officers of Inland Revenue. The remaining nine have other professions. I think in one or two cases they are solicitors.

2881. I understood you to say that the Inland Revenue officers or other assessors employed assessors?—No; the Surveyor of Income Tax may, under the Act of 1857, also be the local assessor, in which case no charge is made upon the local body for salary of assessor.

Mr. J. T. Maxwell.

6 May 1902.

2882. Then these valuations are made either upon the returns sent in by the landlord or by the men who have perhaps very little experience of the value of land?—I understand that in some counties, at any rate, the Inland Revenue surveyor may have the assistance of an expert in land to assist him in valuing—in Perthshire I believe that is the case—in which case the cost of the expert is borne by the county authority, the county council.

2883. It seems rather desirable, does it not, that these valuations should be fixed by men who know something of the value of the land?—I am not aware that the number of complaints or appeals would justify any change.

2884. I am not suggesting that there are any complaints. The fact that 24 out of 33 counties have employed the Government assessor would tend to show that in these cases they do not think it was necessary to employ anyone else?—They can employ whom they please as the assessor.

2885. You think, on the whole, the values are properly fixed?—I have no reason to believe they are not. Of course, there are two appeal courts, an appeal to the committee of the county council or of the magistrates of burghs, and from that to the two judges of the Court of Session.

2886. If you appeal to the county authority, you are appealing to practical men?—Yes, you are appealing to practical men.

Major P. G. CRAIGIE (Assistant Secretary to the Board of Agriculture), called; and Examined.

Major P. G. Craigie.

2887. (*Chairman.*) I suppose we may take your statement as read (*Appendix XIII., XIV.*), and ask you questions upon it. As to loans, do you think it would be practicable that the State should make the advances direct to those who desire to make woodlands?—The question, I think, has been raised, as you are aware, before the late Royal Commission on Agriculture, of the State advancing loans for this and other agricultural improvements.

2888. What is the view of the Department?—The view of the Department is stated very fully by Mr. Elliott in the evidence taken on the 15th March, 1895. As the Commission's notes of evidence are in the hands of the Committee I need scarcely recapitulate them. Perhaps I might be allowed to add that the policy is a very old one, the State's interest in promoting certain agricultural improvements dating back to the year 1846. There was a proposed revival of that older policy in the second report of the Commission, dated 7th February, 1896, and the special questions relating to loans for planting will be found on page 321 of the Minutes of Evidence, Volume III. If I might pursue the subject as to the orginal policy of the State, I would point out that it was limited simply to making advances by the State for the drainage of land. In the years following, 1846-7-8, the expenditure of public money was somewhat considerable, both in Great Britain and in Ireland, on this class of improvement; but although the subsequent system of loans by companies embraced many other matters, planting was not largely thus assisted.

2889. Have you any opinion as to why these loans have been so little taken advantage of?—I think there is a good reason in the case of planting, because there is no immediate return to the owner of the estate; whereas there is the immediate charge for the interest and share of the redemption. In almost all other agricultural improvements, such as we are dealing with every day on a pretty considerable scale, there is some return as soon as the improvement is completed. Farm buildings are paid for in increased rent, and other improvements are paid for by improved returns, or maintenance of rent that would be otherwise reduced. But as regards planting, there can be, of course, no immediate return to the owner of the soil.

2890. Do you think that the system of granting loans might be so arranged as to encourage the use of loans for woodlands, without, of course, involving the State in any risk?—In another system than the present one whereby companies advance the money?

2891. Yes?—I think there would be great difficulties in getting State money. But that is a question of policy. It is hardly possible for an officer of a Department to say what the policy of Parliament would be in the matter. There would be, of course, no absolute impossibility in administering a State loan. It is a question of how far the State would advance money on the security available.

2892. Do you think it would be possible to have loans, advancing money on mature timber alone, as apart from the land where it was grown, on a fixed rotation, showing a fixed annual income. We have had some evidence, which perhaps you have noticed, from Mr. Forbes and others?—I had my attention called to that proposal last night, but I do not think I quite understand it. I should like a good deal more explanation before I gave a final opinion, but on the first blush it does not strike me as a proposal that could be worked. I presume the charge would not be only on the growing timber; but, as a matter of legal obligation, the charge would be on the whole land, and the timber growing upon it. I presume that is the idea?

2893. No, the timber alone?—I gathered from the memorandum that it was the timber alone, but legally I am not quite certain—I am not a lawyer myself, and speak subject to correction—whether there might be a doubt whether you could properly mortgage the timber which is a part of the realty until severed from the estate. Timber is really a part of the estate, which might be already mortgaged, and although I speak subject to correction from lawyers, I doubt the advisability if not the possibility of a second charge of this sort.

2894. The interest of the subject, of course, would naturally have occurred to you in connection with heavily mortgaged estates, where possibly there is a large amount of wood which cannot be mortgaged for the reasons which you have suggested, and the point is whether in this case it would be possible by having a fixed system of felling, so as to show a fixed annual income, to mortgage the wood, and obtain an advance, to be devoted under proper supervision to the extension of plantations or to replanting?—I think there would be very great difficulties of an administrative character in any such plan as that of Mr. Forbes. I think you would have to vest the management of the wood in some outside body, even if it would be possible for the State to advance money on such a mortgage. I do not quite see what the power of recovery would be; assuming the first instalment was not paid what would be the action taken by the State? Would it seize and sell the growing wood?

2895. That would be their remedy, I imagine?—I am afraid that the mere administration of work of the kind suggested would lead to a great deal of friction in the management of estates if it were possible on other grounds.

2896. I have no doubt there are great difficulties, but I wanted to have the benefit of your opinion with regard to them?—I have looked at it as carefully as I can in the short interval I had, and I am afraid the scheme bristles with administrative difficulties. In the first instance, of course, there is the proposal for deferring any payment, I understand, of even a low rate of interest suggested. Therefore the loans could not be granted in the fashion they are now done by the companies, and then the charge sold by them to insurance companies, which is the way all land improvements loans are worked at the present time, because no insurance company or other person lending money could stand out of their money for a few years. There must be a proportion paid from the very beginning, and that would make a difficulty. If the State were to do it, of course, it would require legislation, and I presume it would be intended to place any charge of that kind in priority to existing mortgages on encumbered estates. That would probably be resisted very much as a measure of practical legislation.

2897. Then you are not very sanguine of anything being done for forestry by way of loans?—Not in that direction.

2898. Or in any other direction than that now in practice?—I think the question of the period for which the loan might be made is one quite open to argument. In the evidence to which I have already referred before the Royal Commission, it was pointed out that the rate of interest was not so much a matter of consideration as the period over which the instalments were extended.

Major P. G. Craigie.

6 May 1902.

If you made the calculation you would find that a rate of about 3¾ per cent., which I understand is about the company rate at the present moment, would mean on a charge of 40 years something under £4 17s. per cent., whereas a charge at the same rate for only 20 years would amount to something like £7 per £100. The payment is a very much greater burden in a short period of charge. In a long period of charge it is much lighter, and therefore any relief in the payment of a loan would be greater by lengthening the period than by reducing the rate of interest, assuming the Government could lend at a lower rate than the companies, for I understand the suggestion is that the Government might lend rather more cheaply. At present the rate is about 3¾ per cent. in England, but I am bound to say that in Scotland the rate charged by the company operating there is believed to be a good deal higher. The cases are so very few in which planting now comes before us as a subject of a loan at all that it is a little difficult to generalise. Compared to other improvements it is infinitesimal, and there are almost no cases coming under our notice where planting is required as an improvement by itself. As a rule it is a small subsidiary outlay in large improvement schemes for an estate. There have been only nine cases since the passing of the Act of 1899, which has enabled us to give extended facilities. The total amount of money involved in those, as I showed in the memorandum I have handed to the Committee, is a very small matter (*Appendix XIII.*).

2899. At any rate, there are serious difficulties in the way of anticipating any extensive results for forestry under the loan system?—That is so, unless any relaxation of the period of the charge is made as is now possible under the Act of 1899. Under the old Improvement Acts no charge of that kind could be spread over more than 25 years. Now it may be spread over 40 years, and even if the charge already given has been for a shorter period like 25 years, there is power under this new Act to the Board of Agriculture after inspection within a limit of time to enlarge the charge up to a maximum of 40 years. We have had no application to put in force that provision of the Act, but that power was given us by Parliament in 1899 with the view of facilitating loans for forestry, so that where the actual planting was again submitted to inspection a prolongation of the time might be given. But this will not be feasible, I am afraid, as a matter of practice very often in the case of charges by companies where they have to sell the charges originally fixed.

2900. Another difficulty would be, would it not, that any expenditure in connection with State loans—of such advances by the State—would have to be very carefully supervised?—That is so, and that would mean a considerable expenditure beyond the mere charge itself.

2901. Much more supervision would be required than in the case of any agricultural loan?—It would require a more continuing supervision I imagine; more frequent inspection possibly.

2902. You might have a whole plantation killed by rabbits in a week?—Quite so. In the same way with regard to the suggestion of charges on growing timber, you are liable to many accidents, such as the blowing down of large tracts of forest and the burning of the forests.

2903. The burning might be covered by insurance?—Yes.

2904. One other subject as to which I would like to ask a question or two is with regard to the area obtained from the Ordnance Survey and from the Agricultural Returns, the decennial returns I think they are?—We have obtained statistics at varying intervals in the agricultural returns of the Board of Agriculture, as shown in Memorandum B (*Appendix XIV.*).

2905. Have you any official definition of woodland?—No, that is exactly the point in which such enquiries are defective. The agricultural returns of woods which were taken first in 1871, and again at the different periods detailed gave no definition. The nearest approach to a definition was in the regulation of the 1871 returns, where the acreage was asked for "of woods, copses, and plantations, except gorse land and garden shrubberies." That was more in the nature of a definition than any we have had since. Since that date it has been "woods and plantations." In the two enquiries made in 1891 and 1895, which were more immediately under my own control, we took steps to have a more exhaustive local enquiry into what was being returned to us under those heads by obtaining the co-operation, as far as possible, of landowners and land agents with the Inland Revenue officers, and I think, therefore, those later returns were more complete, but I cannot say that in any case there was an identical definition of what was a wood. But in the case of plantations we inserted in 1891 a proviso that land planted within the last ten years should be regarded as a plantation, and in the enquiry in 1895, which was intended to be supplementary to the 1891 enquiry, we asked for a return of all the plantations that had been planted since 1881, making it a period of about 15 years. So that we have in the two last enquiries something like an enumeration of plantations as distinct from woods, and I do not think there is much risk of error on the ground of absence of definition of a plantation, although there might still be in the definition of a wood.

2906. Do you think it is possible to make a more precise definition to such an extent as would enable us to judge whether the woodland area is really increasing or not, because although the returns show there is an increasing area, that may be entirely due to increased accuracy?—I think that very largely, as I have pointed out in my memorandum, the apparent increase must be due to the increased exhaustiveness of the return, because it coincides with the apparent increase of areas where we know that large areas of woodland have been blown down or cleared. There are individual cases which I myself investigated which leave no doubt in my mind that that increase shown in the return is partly at least a nominal increase owing to more exhaustive returns.

2907. Do you think anything could be done by giving instructions, either to the Ordnance Survey or to the officers that act for you in your Board's returns, to enable us to ascertain more clearly whether forestry is progressing or retrograding?—Your reference to the Ordnance Survey suggests a wholly different method of ascertaining areas. As the Committee are aware, the enquiry of the Ordnance Survey is, if not exactly a cadastral survey, yet a survey on the ground, wherein every acre of the land is recorded. On that local survey is shown, according to the opinion of the officer making the survey, what is and what is not wood.

2908. Then he has no very definite instructions to guide him in returning that as waste or grazing, or as shooting, or as woodlands?—The Ordnance Survey officers in making their enquiry, I am informed by the Director-General, regard as woodland any groups of trees of any age and of any description, except where these are in parks and pasture land, where unfenced clumps of trees are not treated as woods. Underwood on the Ordnance Survey maps is distinguished from woods, and computed separately whenever it is possible. As the Committee are no doubt aware—and I have specimens of the different maps here—on the Ordnance Survey plans fir woods are shown in a different category altogether from deciduous woods; and mixed fir and deciduous woods are shown in mixed character. Those parts of the country in which the 25-inch map survey has been completed have had all the areas of woodland separately computed. The computation books made up locally, but not published, have the data, but no recapitulation of the aggregate woodland areas has ever been made. Any such recapitulation, or putting together of all the computation books, would necessarily entail picking out the woodland area out of the thousands of computation books. It would be very laborious and very costly. It would be of very little value when it was completed, because, as the Committee are aware, different parts of the country have been surveyed at different times, and each computation book can only give the area in the opinion of the officer and the measurement of the officer at the time when he made the survey. These dates may differ by 20 or even 30 years in different parts of the country. Some parts of the country have not been surveyed on the 25-inch scale at all as yet, although they have been completed on the 6-inch scale, and on those parts the area of woods has not been computed. So that the Ordnance Survey cannot be relied upon to give us at any given moment an exact picture of all wood areas even under that definition which I have read to you. The agricultural returns, on the other hand, are taken for a given year, and do give, in however faulty a fashion, the local estimate of the area of woods in that particular year for all parts of the country. There is a great difficulty in comparing the two systems. The only way I can see in which we could arrive at an absolute figure for a given year would be the establishment of a regular cadastral survey, such as many foreign States have carried out, at a given date, of the whole area of the country, showing how it is occupied, using, perhaps, in the process both the Agricultural Returns and the local assessment figures and the

Ordnance Survey data for the purpose, as far as they are respectively available, and bringing them up to date. But I need hardly say this would be a work of immense cost, and take a long time. That would be the only exhaustive process.

2909. You think there is nothing more to be done? The instructions to your correspondents or officers are just as clear as those to the officers of the Ordnance Survey?—I should not like to say nothing could be done to still further improve the returns, but I do not think that any more exhaustive return would give us the means of comparing more accurately the present areas of woodland with the previous position, or enable you to show whether woodlands had grown or declined, because the very fact of making the return better and more correct would make it of less use for any comparison. I had rather hoped that possibly this Committee in its Report might be able to suggest some effective definition which would enable us, the next time our department makes an enquiry into woodlands, as I have no doubt we shall have to do before long, to define more closely what a wood is. It would really be a matter on which advice from practical men would be of value.

2910. One other point, with regard to agricultural education, I should like to have your opinion upon. You give assistance to various agricultural training colleges and other institutions on the basis of a proportion of the expenditure incurred, do you not?—There is no fixed basis. We take into account the amount of local support that is forthcoming before any State grant will be made, but we do not necessarily apportion it exactly to expenditure. To give State money exactly in proportion to expenditure would be rather to encourage extravagance.

2911. I mean that you always get some local assistance. You do not bear the whole cost?—No. In no case do we bear the whole cost; we always take note of the local assistance forthcoming, and we have endeavoured to the best of our ability to give as much as Parliament allows us to have for this purpose, always taking care that there is some local support, and good work done.

2912. Is the percentage which you give ever very large, or is the bulk of the expense levied locally?—I could hardly answer that question generally. You are referring now to the question of planting or forestry?

2913. No, to the grants that you give in aid of agricultural instruction?—Speaking broadly, the State provides for agricultural instruction something like £8,000 in England and Wales, directly through the Board of Agriculture. But it also provides another very large sum through the Local Taxation (Customs and Excise) Act payment handed to the different counties for administration, which is also State money handed over and available for education, of, perhaps, ten times that amount. That is only a rough estimate, made on the basis of the last report of the Department.

2914. Do you give any grant at present for forestry education?—My own connection with the educational branch of the Board's work ceased in December last, but in the last report issued it was shown that although the Board does not make grants allotted to particular subjects, we do give certain grants to various institutions which have forestry in their curriculum. Although my colleague, Dr. Somerville, knows better about the most recent details than I do, I think that at Newcastle, at Cambridge, at Wye, and at Leeds, this subject is taught in the provincial colleges, which are subsidised to the extent of the Board's full grant, which is £1,000 a year. Some portion of that outlay, therefore, is applied to forestry.

2915. (*Dr. Somerville.*) I should like to place myself in the position of a necessitous borrower who has an area of land, and who desires to put a good proportion of that land under plantations, and who desires to come to the Board of Agriculture for the necessary financial assistance. Suppose that one were going to create a plantation by means of a loan through the Board of Agriculture, what steps are taken?—The first step usually taken is either to come direct to the Board with an application for inspection of the site which is proposed to be treated, or, in the majority of cases, to go to one of the companies—there are only three companies at work now; there used to be four—and these companies come to the Board with the same application.

2916. So that the application may be either made directly to the Board or through the medium of a company?—Yes. If you as a landowner applied to my division of the Board to-morrow as to how you were to proceed you would receive a copy of this circular, which, if you like, I will hand in to the Committee, which specifies the particulars with regard to the improvement that you wish to make. That being filled up, the Board would direct one of our permanent local inspectors situated in the different districts, who are the most prominent and qualified surveyors or land agents, to go and inspect the site. But it is an illustration of the very small extent to which planting enters into any of these applications that the word planting only occurs in one line, under Item No. 9, of the subjects of proper expenditure on improvement. The wording is only "Clearing, trenching, planting; probable maximum cost." That is all that has to be filled up in the first instance *quâ* planting. Then the Board receives from its inspector a report on the nature of the work that is intended and the adaptability of the site to the particular purpose, and generally on any feature connected with the estate which is required for the arrangement of a charge under the Acts described in my memorandum, and then a Provisional Order authorising the expenditure is made by the Board. After the work is completed a second inspection takes place, the Board again sending its officer, and, on his reporting that certain work is done satisfactorily, the absolute order is issued either to the company or to the individual, and that absolute order creates the charge on the estate for the period named therein. These are the steps which I understood you wish to know.

Major P. G. Craigie.

6 May 1902.

2917. Might I just ask for some supplementary details; does the inspector on his first visit estimate the probable cost?—Certainly. He has to state this, and information for this purpose is given to him by the agent of the estate. There must be in the application to us an estimate, however rough, of the intended cost. It need not be always absolutely adhered to, as circumstances may arise when the landowner may come to us afterwards and ask us to modify the same on good cause shown, but there must be an initial estimate of what is intended to be the cost.

2918. Then the Board issues a Provisional Order on the strength of the first report of the inspector?—Yes.

2919. Is the owner of the land left to carry out the planting in such a way as he may desire?—Yes, subject to the official final inspection by the Board's inspector, as well as to the preliminary inspection. If the result is unsatisfactory, of course he does not get his charge, or he might not get it for the whole amount. The inspector must certify the amount actually expended, and he would draw the attention of the Board if there was an unduly extravagant or improper expenditure.

2920. And the owner of the woodland may borrow the full amount from a land company?—Yes, if he makes his contract with the company. Sometimes he provides some of the money himself. There is another method by which planting, as well as other improvements, can be proceeded with, and that is where landowners under the Settled Lands Acts 1882-1890, can use capital money in the hands of their trustees for planting, who come to the Board only for the approval of the surveyor nominated by the trustees, who is not in that case necessarily one of the Board's officers, to certify the outlay to be properly incurred. Then there is an alternative to this procedure whereby, also under the Settled Lands Acts, where settled money is available, the parties can apply to the Board to get an inspection, and have the outlay certified by the Board itself. These last cases are very rare, but we have a few of them. Planting is sometimes included in the ordinary improvements carried out under the Settled Lands Acts without the details coming to our knowledge.

2921. Does the landowner determine the length of time during which he shall pay interest and repay capital?—In the case of loans for planting the length of time is determined by the Board. That is in the discretion of the Board. According to the different companies that he may go to, there may be a little qualification of that. There are some companies which have a minimum as well as maximum, but the maximum of the Board now applies to all companies, and that maximum is now 40 years. It is quite in our power to say that this work is of such a nature that we will not give a charge for more than 15, 20, or 25 years. Twenty-five years is a very common period.

2922. During that 25 years the rate of payment is so adjusted that both capital and interest is paid?—Yes. The loans are cleared off at the end of the period.

Major P. G. Craigie.

6 May 1902.

2923. Does the Board or any company exercise any sort of supervision over the management and existence of the woodland after the loan is sanctioned?—None whatever as far as I am aware, beyond the statement as to upkeep made annually where the case is not under the Companies' Acts. In the latter and more usual case, the moment the loan is issued and the charge is made, the practice of the companies usually is that the charge is sold to an insurance company, and there the matter ends so far as either the Department or the companies are concerned.

2924. Then I suppose the general principle of these loans is that the estate on which the improvement, in this case planting, is effected, should be benefited to the extent of the expenditure to effect this particular improvement?—Quite so, directly or indirectly, in the case of planting. We have a little more latitude than in the case of farm buildings, because, as I pointed out in my Memorandum A before the Committee, the old Acts recognised in the case of planting that it was not necessary to prove immediate pecuniary benefit to the estate. There is general and indirect benefit in the way of amenity and general improvement which has to be taken account of beyond the actual money return.

2925. And the whole estate is mortgaged for the repayment of the loan?—Not necessarily the whole estate in all cases, but a sufficient area of the estate to justify the charge. That is again a matter which would have to be submitted to us.

2926. It is quite conceivable, I suppose, that the owner of the estate may fail to take sufficient precautions to insure the existence and healthy development of the plantation that has been so created?—I am afraid it is quite possible that that might happen.

2927. And it is conceivable that an estate may be burdened by a considerable loan for the purpose of effecting an improvement, and yet this so-called improvement may be so neglected that an estate may be little, if at all, benefited by the charge that has been made?—It is quite conceivable that that may happen. Against that, though, I would put the fact that it must be remembered in dealing with this that the amount of money borrowed for planting is excessively minute. In the whole woodlands of the country there must be a very small area which in any way owes its origin to the loans through this cause. The total sum spent on planting from the beginning of the system more than 50 years ago does not yet reach £100,000.

2928. Under the present system, of course, it is not to the interest of the State or of the companies to secure good management in the woods that are created in this way, because the rest of the estate, or a portion of the estate, is burdened for the creation of these woodlands. But if it were conceivable that the woodland itself were burdened with the loan, then I take it it would be quite necessary for someone to see that this woodland so created was actually maintained, and also that it was properly managed and utilised?—I think that would be so, but it would require a very large area of woodland to give the security. You could not do that in the case of very small properties. You want a large margin to fall back upon if it were limited to woodland. Perhaps I ought to add that, referring again to the point, there is a value beyond the mere keeping up for timber purposes; we find as a matter of practice that the planting is often recommended on the ground that it adds to the saleable value of the estate from reasons of beauty, amenity, sporting and various other considerations. Woods might thus be kept up in some form, although there was some neglect from the purely forestry point of view in the maintenance of the woodland. There are often old woods which would be of great value to the estate in the market, and therefore the value of the loan is secured in a sort of way, although there was some neglect of the timber value.

2929. (*Mr. Marshall.*) You have very kindly given us some information about the Ordnance Survey, and you told us that there is a certain definition that trees that are grown in groups are described as woods, and those that are grown singly in pastures and parks are not taken into the woodland area. In some counties, particularly in the South of England, there are very woody hedgerows, which are locally called rows. Could you tell us whether those are included in the woodlands or, in the agricultural term, as part of the field?—I think perhaps, if the Committee will allow me, my best answer is to hand in a copy of the 25-inch Ordnance map. This is part of the County of Sussex. The areas scaled on that map will show you where the strips are wide enough to be entered, which is really an answer to the question. A good deal depends on whether those narrow strips are inclosed or not. I would call attention to the fact that in one instance this strip of woodland would not be measured as wood, whereas the other strip would be measured, the difference in the two cases being the fence, keeping the wood in; but very much must depend on the closeness of observation of the officer making the survey, and the fencing at the moment when the survey was made.

2930. You very kindly tell us that 102,671 acres of plantation have been planted within the last ten years?—Not within the last ten years. We have had no survey of woods at all since 1895, and the area of plantations at that date regarded as plantations was everything planted between 1881 and 1895.

2931. There is a good deal of agricultural land gone out of cultivation within the last ten years, is there not?—There is a certain amount, not a very large percentage, gone absolutely out of cultivation; but a considerable percentage has gone out of arable cultivation and into grass.

2932. Have you any knowledge that any of this land which has gone out of cultivation has been taken advantage of to plant?—I have. We have cases where enquiry has been made as to why the cultivated area of a given parish has been reduced, and the answer is given that a certain proportion has been used for plantation. I do not say these were very numerous cases, but such cases have come under my knowledge. One main cause of the land going wholly out of cultivation is the encroachment of towns on the country. It is not always recognised that the taking up of land for building is a very important element in the movement.

2933. As you have only had nine applications since 1899, and the total amounts charged since 1847 are something under 100,000*l*., the people who have availed themselves of planting their lands have not been to the Board of Agriculture or land companies to borrow from them?—It is very rare that applicants come to us for loans under the Acts for planting only.

2934. During Professor Somerville's question I think he said something that these loans were payable capital and interest together?—That is so, in regular instalments.

2935. The number of years that the money is borrowed over is put into a lump, and the interest calculated, and that is divided into so many periods?—Yes, spread in exact proportions over the whole period.

2936. Since the period has been extended from twenty-five to forty years you have had nobody take advantage of that at all?—Since the passing of the Act of 1899 there has been no application made to the Board to extend a charge previously granted from the twenty-five years, which would be practically what had been given, to the forty years. I may mention that out of the nine cases which have come before the Board in the last two years, which has been the period since that Act came into operation, just two of these have had a maximum period granted to them on their original application. But there is no case in which we have been asked to take advantage of a section of the Act which enables us to extend an earlier charge to forty years.

2937. (*Sir John Rolleston.*) Do you say there were only nine applications since 1899?—Yes, for planting.

2938. I have never heard of one or known of one?—I should think that very many of our inspectors have never heard of them at all. I have only taken charge of this department during the last few months, but I have examined the older entries, and nothing has struck me so much in looking up these figures as the fact that the records are very few of special loans for planting alone being asked for. We get all sorts of subjects. The extension of mansion houses is one of the largest, and expenditure for labourers' cottages occurs very frequently. It is only rarely now that we have drainage, but drainage is more frequently asked for than planting. Planting is, of all subjects, very much the smallest, and I think that is quite clear from the data published in the last report of the Board, and in the memorandum I have handed in.

2939. Do you think that landowners know generally that they can borrow money for planting?—I do not know how far it is generally known among landowners. It is, of course, well known to the companies, and companies, being commercial and businesslike institutions, have every interest in spreading public knowledge of the fact that they can do this, because they take a certain profit upon each transaction. There are no surer

Major P. G. Craigie.

6 May 1902

means of getting things known in this country than allowing people to have a commercial interest in promoting the work. The companies themselves, under Act of Parliament, are entitled to make a commission of 5 per cent. on the outlay.

2940. Only the companies would rather effect loans for building and that sort of thing than planting, because of the security. Security is necessarily the difficulty in this class of loan?—Quite so. And they could not well take a loan which would be liable to be altered and extended in period. This would clash with the practice of the companies in selling those charges to insurance companies. It would not be as a matter of finance a very easy business to have anything but a loan for a fixed definite term to begin with in these cases. Therefore, where the money is coming through the companies I do not think extension can be often granted by means of Clause 2 of the Act of 1899.

2941. It seems very necessary that the plantations should be made under Government supervision, does it not, before much money can be lent in that direction?—I think the State would not lend without very close supervision, and the cost of that supervision would be almost prohibitive to the commercial advantage of planting, perhaps.

2942. I think you said in the first few years the life of a plantation might be completely destroyed?—Entirely; it would be a very difficult matter to control.

2943. I was glad to hear you say that the Government Department had recognised that plantations improve the value of an estate beyond the actual value of the wood, and that they are prepared to count this added value in their security?—To take that into account in determining the security, I think, is only fair. We consider this is a matter of ordinary market practice—an estate sells better when nicely timbered.

2944. There have been several witnesses before this Committee who have been unanimous in the expression of opinion that a well planted estate is more valuable than the bare estate, apart from the value of the wood itself?—Yes, quite apart from the timber value.

2945. What do you call gorse land?—Land covered with whins or gorse.

2946. Which is let for grazing purposes?—Not always; some of these areas contain a sort of rabbit warren.

2947. Are fox covers included in your return of woodlands?—I think probably not, gorse land is omitted.

2948. Fox covers planted with gorse and blackthorn and privet are regular enclosures. There is a very large area in the Midland counties of land planted in that way, which would not be woodland?—I should like to reserve an opinion to how far they are or are not wood under the Ordnance Survey. I have known a case of the Ordnance Survey maps showing an area as wood the extent of which was only ·017, and another ·019 of an acre, so that a very small corner with something growing on it of the nature of wood must have been regarded by an officer as wood.

2949. The principal planting in some parts of the Midland Counties seems to be fox covers?—I do not know that I should go so far as to agree to that.

2950. Do not many landowners plant fox coverts?—There is no doubt that the question of planting for sport is an element in planting. A good deal of the plantations we have heard of lately have been planted with a view to game.

2951. They have a sporting value?—Yes, apart altogether from the value of mere appearance or the value of timber.

2952. They have a higher value than open land?—Yes, as making covers.

2953. New plantations?—Quite so.

2954. (*Colonel Bailey.*) I am not quite sure whether I rightly understood you to say that the returns made by the Agricultural Department are not based on the Ordnance Survey?—Not in any way based on the Ordnance Survey.

2955. The Ordnance Survey is not used for your purpose?—I should qualify my answer by saying it is always open to a local officer of Inland Revenue who is in doubt as to the figures sent in by the occupier, to refer to a map, and there are cases, where some puzzling questions of area have cropped up, in which in our own office we would naturally refer to the ordnance map on a point of correction, but the returns are not based on that primarily at all. They are based on the schedules returned by persons on the list of occupiers as given locally, although the rate books, as you are no doubt aware, are sometimes very imperfect, but still the rate books are open to the inspection of officers who take the agricultural returns; and by their aid and local knowledge the schedules are addressed to all the occupiers of over an acre of land.

2956. I think you said you were willing to accept a suggestion from this Committee with regard to some definition?—We should be only too glad.

2957. You have at present woods shown under two heads—plantations and woodlands. Are they shown together or separately?—Separately.

2958. Plantations such and such a year and woodlands for the same year?—Yes, for each county in the returns. I can show you exactly how they are entered. (*Handing in returns.*) That is the most recent return. Every county shows the amount of woods and the plantations.

2959. There are just two headings?—Yes.

2960. Take the case of an area from which a matured tree crop has been cut, but on which no replanting has been done, what would that be called? I ask you the question because it is within my knowledge that on some estates there are areas which have been bare of trees for 10, 12, or more years, and which it is the intention of the proprietor to replant. To all intents and purposes they are woodlands on which the crop is at zero at the moment. How would you class them?—That is no doubt one of the class of cases which have caused a good deal of difficulty in the returns. I have myself no doubt that the officers employed in collecting the returns may have differently interpreted their instructions in such cases. There was an instance in the county of Inverness when I was making the last report, in which the exclusion of an area of so-called forest was explained on the ground of its being very sparsely covered with trees, and in part largely denuded of timber. That answer was given to me.

2961. So that some kind of definition or general instructions for the work would seem to be very necessary if we want anything accurate?—That is precisely the reason why I have rather suggested to my Department that it would not be well to make a new return of woods until we had the advantage of an enquiry such as this to see if we could get any more accurate definition; but if we did, I do not expect it would enable us to get an absolutely accurate figure, although perhaps a better figure.

2962. It strikes me as being a very extraordinary thing that use is not made of the maps of the Ordnance Survey as the basis of these returns?—The Ordnance Survey contains an immense amount of information which might be of value on the matter. But neither the 6-inch nor the 25-inch survey could be in the hands of each of the 1,200 officers who collect our returns, and certainly not in the possession of the half million of persons who fill up the schedules. That, of course, is a practical difficulty. There have been a great many suggestions for definitions of what woodland districts ought to include, and the matter has been under the consideration of the International Statistical Institute, and we had a paper read last year at Buda Pesth by one of the Hungarian officials on "International Statistics of Woodland," which may give some help towards future work. They have gone into this in much more detail in foreign countries, and I could put these suggestions in if desired.

2963. It has struck me whether it would not be desirable to ascertain how the information is recorded in other countries?—We do in the agricultural returns make a statement of total forest areas for such countries as we can obtain the information from. As you are no doubt very well aware, in different countries the methods of obtaining these figures differ very largely: there are differences between the German and the Hungarian, and between the Swiss and the Swedish systems. In some cases areas are included which we would not call wood at all, but very small scrub.

2964. I know that in the returns of the wooded area in France they make an estimate of the area that would be covered by hedgerow trees and isolated trees if such trees were assembled together?—Foreign statistics differ very much, and therefore they are not strictly comparable. I have seen a good deal of several of these Continental forests, and we have had some discussion on this point, and a Committee of the International

Major P. G. Craigie.

6 May 1902.

Institute goes into these matters; but the improvement of returns proceeds very slowly.

2965. (*Mr. Lewis.*) I believe in France they spend very large sums upon their Cadastral Survey?—I believe they do.

2966. The main difficulty, I understand, with regard to compiling the returns as to the area of land under wood in this country from the Ordnance Survey is that that survey is continually going on in different parts of the country, that the maps are published at different times; that there may be an interval of many years between the publication of, say, the maps relating to one county and the maps relating to another county, and that therefore in any given year it is impossible to have a general, comprehensive, and accurate survey of the country as a whole with regard to the area of its woodlands?—That is so; it cannot be synchronous. There may be a difference of 30 years between one of these maps and another.

2967. With regard to the amounts which are devoted to agricultural education, are you absolutely limited to the sum of £8,000 for any one year?—In every year the amount is necessarily inserted in the estimates of the Department.

2968. That amount for several years past has been fixed at £8.000?—I think not. Almost every year of late there has been a slight change. Some years ago, when a fixed sum of £5.000 originally was fixed, it went on for several years. But at the present moment there is just the same amount of fixture as in any other item in the estimates, no more and no less.

2969. Does it depend to some extent on the applications made from time to time for help?—It would depend very much, not upon the applications, but upon the cases where, after application has been made, necessary and deserving work has been found. We have had applications which necessarily caused us to enlarge our demands on the Treasury, with whom, of course, it is necessary to reckon.

2970. Have you had many applications for help for instruction in forestry with which you have been unable to comply for want of funds?—I do not think we have had many applications of that nature which I can call to mind, and entertainable on other grounds with sufficient local support, where they have been absolutely refused on the ground of want of means.

2971. Have you had any such applications?—Speaking from memory—my colleague, Dr. Somerville, has a more recent experience than I have—we have, of course, on frequent occasions had general applications that more money should be spent on forestry; and we have considered these in giving grants to the institutions which teach forestry, up to the maximum figure given to an institution. It would not be in the practice of the Board to go beyond that maximum for a particular subject. That would alter the whole system. If you are referring now to forestry by itself, I think I may say we have never had to give a grant specifically for forestry instruction in England by itself, but such instruction must be taken into account as part of the general scheme.

2972. Supposing an application was made on the part of the University Colleges, and that application were backed with promises of local support, I presume the Board of Agriculture would be in a position to seriously entertain an application of that kind?—They would no doubt most seriously consider any application made to them, not only in the light of local support, but also in the light of the demand, the number of pupils likely to be forthcoming, and the sufficiency of the arrangements proposed. They would be unwilling to add to a grant of a general nature one for a single course of instruction for which there is no local demand. Nothing has been more disappointing to the Board than the number of pupils in different parts of the country forthcoming to take advantage of the provision made for agricultural education, and this is true very specifically in forestry. The number attending special forestry classes is peculiarly small; therefore the Board, before entertaining an application, would have seriously to consider whether it is likely to be of use to a sufficiently large number of persons to justify an expenditure of public money.

2973. Comparing the number of students in this country with those in other countries, I presume the percentage in the United Kingdom would be extremely small?—I am not quite in a position to speak with regard to other countries generally, but compared with certain countries it would be so.

2974. It shows it is necessary to do something to create an active interest in the work of forestry?—That has to some extent been acknowledged, but the work of teaching forestry rather depends on the question of what is the object for which people are coming to learn forestry. At present there is no great avocation in this country to be so reached, and little opportunity for the practice in any remunerative way of forestry as a profession.

2975. (*Professor Campbell.*) I have been exceedingly interested in what you have said with regard to loans, and I think most of the questions I wished to ask have been already put. Do you happen, in your experience, to know of any system of loans for planting in other countries?—I am not aware of any system myself, because the large forests of which I know anything in other countries are practically State forests, and therefore the question does not arise.

2976. You are not in a position to give us your views with regard to State forests in this country?—No, that would belong to another Department as matters now stand.

2977. During the last ten or twelve years there has been a very great increase in the demand for agricultural education, has there not?—Certainly.

2978. And a large number of farmers have benefited by such education?—Undoubtedly.

2979. Apart from the class instruction and apart from their actually having taken part in demonstrations, farmers have been indirectly benefited thereby?—Yes.

2980. That has been largely due to the general interest which has been created?—Yes.

2981. People have read more, and so on?—Yes.

2982. I suppose you are of opinion, in the same way, that if more attention were devoted to forestry, we should have much more attention paid to our woods and forests?—I should hope that would be so.

2983. In fact, the experience of the last twelve years distinctly points to the fact that there would be?—I think so; there is, no doubt, room for creating more interest in what we might call not necessarily forestry, at all events woodland, management in this country.

2984. We could look forward with considerable confidence to an increase in planting if there were some better means provided for forestry education in this country?—That is not quite so certain, for it must be remembered that a good deal of the increase of interest in agricultural education, at all events at first, as regards pupils attending classes, has been caused by the creation of new teaching avocations, which has helped to draw pupils who wish to be employed as teachers all over the country, and you have not anything of the kind as regards forestry. There is no such avocation in forestry corresponding to the local lectureships for general agricultural teaching under the counties, and the posts where knowledge of woodland management are wanted are usually land agencies of a general character.

2985. Yes, but it must be within your knowledge that there was a considerable amount of prejudice against agricultural education ten or twelve years ago, and that has broken down to a great extent?—I hope it has been broken down. There has been at least a great advance.

2986. I am myself of opinion that in a similar way we could very largely increase our interest in woodlands if we had a system of forest education, and I merely wish to know whether you share my opinion in that?—I am quite sure if we could assist in any way in diffusing more general instruction in forestry to those concerned in land management, it would be what the Board would desire to do, if a feasible scheme were devised.

Dr. W. Somerville.

Dr. WILLIAM SOMERVILLE (a Member of the Committee), called; and Examined.

2987. (*Chairman.*) You are President of the English Arboricultural Society?—Yes.

2988. And you have pursued your forestry studies on the Continent, and published your views upon the subject, and on many interesting subjects connected with forestry?—Yes, I have.

2989. You have been, for a long time, in close contact with many of the practical foresters of the country, I believe?—Yes, I have met most of them.

2990. Could you give us your views as to what you think is wanted to maintain forestry in the United Kingdom?—I am in complete sympathy with the scheme

Dr. W. Somerville.

6 May 1902.

that has been sketched by Colonel Bailey, and with the system which has been advocated by Dr. Schlich. I think that the educational systems that they recommend will, so far as they go, practically meet the case, and I have no doubt that ultimately, when they are completely developed, they will leave nothing to be desired. But, of course, at present we are more or less in the initial stages of the movement, and it is often necessary to do some pioneer work before the matured schemes are complete. And I think there are perhaps a few other directions in which something might be done that have not been touched upon so far. For example, the system of local lectures and local instruction generally for foresters, I am sure, has certain advantages, although it cannot be offered as a substitute for the more elaborate schemes that some of us have in our minds. Colonel Bailey has already told us of a successful course of lectures—a very short course, it is true—which he gave in Aberdeenshire, and I have had some experience of the same system in the north of England. Within the limits of this particular development, I am sure that a certain amount of good is very readily done to a locality. One gets the foresters of the neighbourhood to come in to a weekly class during the less busy months of the year, and if such classroom instruction is combined with occasional visits on Saturday afternoons to the woods in the neighbourhood, the foresters are certainly placed in possession of some ideas and information which they would not otherwise have acquired. And such lectures, I think, might very well form feeders, as it were, for a more elaborate and more complete system. You stimulate interest through these lectures, and you complete the educational process by means of more complicated and more perfect machinery.

2991. I suppose those lectures to which you refer were attended almost entirely by working foresters?—Yes, I should say entirely by working foresters. In the case of the course at Hexham, which ran through two winters, I think the audience comprised the young men who were employed during the day in the extensive nurseries which are met with in that district, and foresters on the estates in the neighbourhood also came in on one evening in the week. But, as you have said, they were chiefly working foresters. That idea, it seems to me, is capable of considerable development. From my own observation, I am sure that some of the men, at any rate, who came within the influence of such instruction were considerably benefited by it; and as a matter of fact if they had not got that they would not have had anything at all. Because, however desirable it may be that the rising generation of foresters should pass through a properly equipped forestry school, the fact remains that only a very small proportion, I think, of those in the country will, for some time at any rate, receive benefit from such instruction. Then the same idea was carried out in another way, where the Northumberland and Durham County Councils gave scholarships sufficiently large to cover the expenses of travelling to Newcastle on one day in the week during a whole winter, and in place of the instruction being given at a local centre, as at Hexham, they came into the college at Newcastle, where, of course, we had a better equipment in the way of specimens and diagrams, and to some extent, microscopes. They then got instruction there and returned to their homes in the evenings. I do not think I have any very strong views as to whether one system or the other is the better. Sometimes it might be convenient to have one of these forms of instruction, and at other times it might be well to have another; but at all events, the instruction which was given was thoroughly appreciated, because we had very large numbers indeed, both at the local lectures in Hexham, and to the evening lectures in Newcastle.

2992. One might regard these lectures perhaps as a sort of primary system of instruction for the foresters over the whole country?—Yes, I think that now, with so many collegiate centres established throughout England and Scotland, a good deal more might be done in that direction than has been done. There are many centres which are obviously suited for the purpose, such as Perth, Inverness, and Aberdeen in Scotland, and certain districts in England which are well wooded might, I think, be brought under some such system as that, as a preliminary step, but not as a substitute for the larger schemes which have already been discussed. And then the County Councils, it seems to me, can do a great deal in the way of establishing demonstration plantations upon the experimental farms which a great many of them have started now. You have experimental farms in such places, for instance, as the West of Scotland, Newcastle, Leeds, Lancashire, Cheshire, Nottingham, Cambridge and Wye, and possibly other places, and although these farms are designed primarily for demonstrations in agriculture, there is no reason why, I think, in most cases a small area, say anything from 10 acres upwards, might not be placed under demonstration plantations to show what is meant by different systems of mixing, and different systems of planting, and different systems of management. With your permission I shall hand in some photographs of some such demonstration plantations which were formed on the experimental farm of the Northumberland County Council. These were started in 1898, that is to say, they show four years' growth at the present time, and in a very few years I hope that they will supply some really useful object lessons. Not only do they supply object lessons in sylviculture, but they also give information as to the suitability of certain trees to the locality. Take as an example the Sitka spruce, which does exceedingly well in some localities, but we find in Northumberland that the results so far are scarcely successful.

2993. You find that the County Council areas are valuable for local lectures, just in the same way that a school forest is valuable attached to a forest school or university?—Yes, I think the analogy is complete.

2994. Besides the system of local lectures in Northumberland, and the County Council plots which you arranged there, you have had some experience also of University teaching?—Yes, both in Newcastle and also in Cambridge. I gave lectures on forestry at both Cambridge and Newcastle. The College at Newcastle is part of the University of Durham, and the agricultural students which we got there were prospective farmers and prospective agricultural teachers, and not so much prospective landlords. But forestry was part of the curriculum, and is part of the examination for the degree of Bachelor of Science in the Department of Agriculture in the University of Durham. In Cambridge lectures on forestry have been given since the Agricultural Department was started there, but the subject does not form part of the degree course, it is a purely voluntary subject, and when a subject is purely voluntary and leads up to no examination, one may be quite sure that those who attend the classes are really interested in the subject, and find that they are deriving some benefit from the study. I should say that the numbers attending such a class are a much better test of the value of the subject than in the case of a course of lectures which qualify for a degree, we will say; and measured by this standard, we found the lectures at Cambridge were very much appreciated indeed. The class in forestry was scarcely less in size than that on agriculture; it attracted all sorts of people, and bursars of colleges who were of course managers of land in some cases attended the lectures, and the undergraduates who had a prospect of coming into landed estates in some cases have come to them. Altogether I think there was a very considerable amount of enthusiasm about the lectures on forestry there, and if it had been a subject which was compulsory for a degree the numbers would have been considerably greater than they were.

2995. Did your Cambridge classes get the attendance of the landowning class?—Yes, very largely, I think. The audience was largely composed of those who either owned land or were likely to own it, or who were qualifying as estate agents.

2996. At Hexham you found yourself carrying on your educational system at the elementary stage, that is to say, amongst the working foresters?—Yes.

2997. At Newcastle you were dealing largely with occupiers of land and estate managers, and at Cambridge with men who were likely to own land and also manage it?—Yes, I think that is a fair classification.

2998. What do you think is the most pressing requirement?—I quite agree with the witnesses who say that the education of the landlord is the most pressing requirement before very great improvement can be effected. Until landlords can be convinced that forestry can do a great deal more than they believe at present can be done to develop the estate financially, I do not think we shall have a very great extension of sylviculture. So I think it is of the highest importance that opportunities should be given to the prospective landowners to acquire some knowledge of the subject, and that of course can only be done effectively, I think, through providing instruction in forestry at the centres

Dr. W. Somerville.

6 May 1902.

of education to which the young landowners resort—that is to say, Cambridge and Oxford, for the most part.

2999. Have you any views as to the most pressing requirements to attract that class?—I think the student will be attracted if the instruction is offered to him. We shall only at the most, of course, get a small proportion of the total number, but the best of them are always quite ready to come to instruction in forestry. It is a subject which appears to appeal to them more than many other subjects do.

3000. With your experience of Cambridge, do you think it a good centre?—It is an extremely good centre from the point of view of getting the kind of man you want, but it is not a good centre from the purely forestry point of view; there are very few woods in the neighbourhood of Cambridge, and therefore we had not many facilities for demonstrating on the ground what we wanted to teach them.

3001. Would the class of student that is likely to study at Cambridge take part in tours abroad, to the Continent?—Yes. Of course he is very much inclined to join what is called a reading class, and I myself did take a small party across to Germany last year, and I am sure that that idea might be very considerably developed.

3002. You believe, I suppose, that there might be a considerable and profitable extension of the timber-growing area of this country?—Yes, I think a very considerable extension might be made with profit.

3003. And, apart from private ownership, do you think there is much field open to the State to encourage or to undertake commercial forestry?—I am afraid I could hardly give an opinion that would be of any value on that particular point.

3004. You would concentrate your efforts on training the private owner?—I should concentrate my attention, I think, on stimulating interest amongst private owners, and endeavouring to effect an improvement in that way, just as one does in agriculture, through the agency of the private owner.

3005. (*Mr. Stafford Howard.*) Can you give the Committee any idea as to the number of pupils you had attending, in the first place, the Hexham lectures?—I have not the figures by me, but somewhere between 20 and 30.

3006. And that is a district where there are large nurseries, and therefore there is a number of men specially interested in the subject?—Undoubtedly it is a favourable centre.

3007. You would not find the same thing in any ordinary agricultural district?—No; localities would require to be selected with very great care.

3008. With regard to the lectures in Newcastle, about what number attended them?—Very much the same number.

3009. How many of them came in with scholarships?—They all came in with scholarships that attended the evening classes in forestry.

3010. So they all came from outside?—Yes; these were special classes organised by the adjoining County Councils. Beyond these there was the regular day work in agriculture, classes attended by the men who were putting in a three years' course at the University, and the numbers in that case were less.

3011. Those were students at the University?—Yes, at the College of Science.

3012. The evening lectures were attended only by those who came in with the scholarship money?—Yes.

3013. Did they come any distance?—In some cases more than an hour by train.

3014. So they would be able to get back the same night?—Yes.

3015. There is no reason, I suppose, why the other County Councils should not do the same thing if they thought it was worth while?—There is really no reason at all why they should not.

3016. And as some of them are spending a good deal of money on agricultural demonstration farms, you think they might add forestry to that in some cases?—I think they would be quite willing to add forestry to it if they could get the instructors. In my case it was largely a personal matter. I suggested things to them, and they were good enough to adopt my suggestions.

3017. That is the only place; that is to say, Durham and Northumberland are the only counties which have given scholarships for this purpose?—So far as I know, they are.

3018. At Cambridge what sort of numbers attended the lectures there?—I think the class there ran from 12 to 15, which does not appear to be a very great number, but when one considers that they persistently attended during the three terms which constitute the year, I think it is quite a satisfactory number.

3019. Were these lectures given as an ordinary part of instruction at the University?—Yes, as part of the instruction at the University.

3020. Not as an outside subject?—No.

3021. Is that continued still?—I really cannot say whether my successor there has carried on the work or not.

3022. You carried it on for three years?—I did really more than that: I must have given lectures there for four years, at any rate.

3023. And you found a difficulty there from not having any practical instruction area within your reach?—Of course an area for instruction within a convenient distance would have been very useful indeed, and enormously important.

3024. Did you ever visit any of the adjoining properties on which there are woods?—Yes, we had to do that; but Cambridge is badly situated for getting at any woods within easy reach which are worth going to.

3025. (*Professor Campbell.*) You have taken a very great interest in agricultural education, I believe, Dr. Somerville?—Yes.

3026. You were one of the pioneers of that work. Do you find that as the result of the work which has been undertaken in the last 10 years a great amount of prejudice has been laid, and that now there is a great interest in the subject compared with what there was formerly?—Yes.

3027. What I personally believe, and I want to know whether you agree with me, is that if the same were done with forestry you would have the same results. Do you think that is so?—In the case of forestry we have no prejudice, to begin with. The British forester is a man who is prepared to receive instruction without any attempt to pick faults with it; he will receive the teaching without criticising it.

3028. Is that very general?—According to my experience the British forester is keen for instruction, and looks with no suspicion upon it.

3029. Still, there is a lack of interest amongst landowners, is there not?—Well, I do not know.

3030. There is a lack of interest on the matter in this country?—There is a lack of interest in a way, certainly.

3031. But would you attribute a great part of the present state of sylviculture in this country to lack of interest?—Yes, but it is really a lack of knowledge. Landowners in many cases have no idea of the possibilities of improvement. But when the possibilities are pointed out to them they appreciate them in many cases readily enough. But in many cases people simply believe that trees are planted, and that afterwards they come, somehow or other, to fellable age, and that there is no opportunity of influencing the development by management. The want of improvement in the past has been due to ignorance rather than to prejudice.

3032. Ignorance on the part of the forester?—No; ignorance on the part of the landowner.

3033. But, as a rule, if the landowner's interest was aroused, he would soon give his forester better facilities for education?—No doubt he would appreciate it.

3034. I believe that this is largely a matter of stimulating interest, and I want to know whether you agree with me. My experience in agriculture is that progress has not been so much due to direct instruction, but indirectly to increased interest, which has led people to read and think?—But in the case of forestry we start from an entirely different standpoint.

3035. You think the analogy does not hold?—In agriculture I think the English might be said to have been as far advanced in agricultural practice as any in the world 10 or 12 years ago, when this educational development started. In the case of forestry, when you start education in England you start from an abso-

Dr. W. Somerville.

6 May 1902.

lutely different plane. We may say that no forestry in all the world is so bad as English forestry.

3036. Do you think landlords realise that fact in this country?—They do not realise, I daresay, in many cases, what the condition of things is, and that it is as bad as it is; but a great many of them realise that improvements are possible, and we see most gratifying evidences of its appreciation in many directions.

3037. And that needs to be spread?—Yes, and it is spreading.

3038. I have asked the question once or twice of other witnesses, whether the providing of experts who would visit forests and give advice to landowners or to foresters would be an advantage. What do you say?—There are such experts now, you know, and they are utilised to a certain extent.

3039. Do you think that a large extension of that system would be an advantage?—I think it is the only possible way of effecting improvement in the case of small areas and small owners.

3040. And that there is urgent need for a number of instructors of that kind?—It is very desirable that there should be such facilities.

3041. You agree in the main with what has been said so far with regard to forest schools and model forests, I take it?—I agree entirely, I think, with what has been said on that matter.

3042. Have you, by any chance, prepared anything which you can give us now with regard to the course of study which you recommend? Or is that a matter which has not been worked out by you yet?—I have not an elaborate scheme prepared, but there is very little room for diversity of opinion on the matter. I think probably we should not have any difficulty in arriving at a thoroughly useful course of instruction.

3043. For example, with regard to the difference between instruction suited to foresters and that provided at college for landowners and agents, would you be in favour of supplying a substantial course to the working foresters at the forest school? Would you say we should have class-rooms attached to the forest school, and courses of instruction given there?—You must, I think, have a certain system of instruction, of course. The forester wants instruction more particularly in regard to the diseases of trees, so that he may readily recognise diseases when he sees them, and be able to nip them in the bud. He must have a knowledge of entomology, because the working forester is a man who is amongst trees, and he is able to see whether any injurious insects become very abundant or not. And then he ought to know the general principles of tree growth and the structure of wood. And as regards out-of-door work, he must receive instruction in the very best method of planting and felling, and so on. But the landowner, of course, ought to be instructed rather in the economics of the subject, such as in the question of rotations, the length of rotations, and the financial aspects in a broad general way, rather than in matters of detail.

3044. But still, you would advocate a course of scientific instruction at the same time?—Yes, to a certain extent, certainly.

3045. I suppose you are not prepared to give us any suggestion with regard to the cost of any of these schemes, because that is a point which is scarcely before us?—I think something like £600 or £700 a year in the case of the forest school. Of course, the instruction in the universities, which would come later, would depend upon the salaries which one is prepared to give to the lecturer or professor, as the case may be. I should say that a forestry school could be very well run by two special men. One of those would be the director of the school, and would perhaps instruct in sylviculture, broadly speaking, including forest mensuration; and the other one would be the junior, who would take the natural science subjects—botany and zoology, and so on. These two men, then, between them, would give all the instruction which it is necessary to give to the working forester who would come to the school. And the salaries of these men, as I say, could be put down, I think, at £600 or £700 a year for the two. The man who took natural science would be prepared and able to carry through some research work on the growth of trees; and perhaps the other man might also be able to find time to do some experimental work, too.

3046. That would be the annual expenditure? Of course, there would be a certain cost over and above that of acquiring a forest school; and in that connection I want to have your opinion with regard to whether you would work this forest area entirely for profit?—I agree absolutely with what Colonel Bailey said, that the ultimate test of the success of a forest area must be financial success. If it is a failure financially it is an absolute failure in every way.

3047. Do you apply those remarks to a demonstration farm?—The two things are not strictly comparable. I regard the experimental farm as an open-air laboratory. But in the case of a model forest, so-called, a very small portion of it indeed would be under strict experiment or demonstration; the rest of it would be run purely upon financial lines. But a certain amount of it would certainly have to give results other than financial results. Trees might have to be cut down before they were ripe; they might have to be artificially infected with disease even. So that a certain portion of the area could not be expected to be run as a financial success.

3048. Such areas might have to be planted with trees unsuitable for the district?—Yes, within limits. One might have to put in something which one was not quite sure about.

3049. (*Mr. J. H. Lewis.*) You speak of the admirable work which has been done by the establishments of the Northumberland and Durham County Councils. Is there any special reason why those should have taken up the question?—No reason, except that I was there and stimulated them in that direction.

3050. It would be possible, I take it, for other counties in different parts of the country to take up the work in the same way?—Yes, quite, if they can get the men.

3051. It is, I suppose, very desirable that in our County Councils there should be one or two men who take an interest, I might say who feel an enthusiastic interest in the question, which would help it on very materially, I presume?—Yes. I think if there were such men the teachers would be obtained. But the number of men who are qualified to give instruction in forestry is very limited.

3052. At the present time you mean?—Yes, very limited indeed.

3053. Do you think it will be so for some time to come, or are there signs of improvement in that direction?—Yes, there is improvement. Even now, compared with ten years ago, the position is very much better. There are a certain number of men capable of giving this instruction. They have learnt a good deal in this country and then have gone on to the Continent; they have gone across and come back again. They are perfectly well qualified to give thoroughly reliable instruction, but they are not being utilised to any great extent.

3054. With regard to the local students you had at Hexham and at Cambridge, do you think that not only is good done to them by the instruction which they receive, but that indirectly a great deal of good may be done by the interest they are able to arouse in others, and by the information they are able to impart?—I think there is no doubt that the enthusiasm radiates from them when they get back into their situations again.

3055. What area do you think an experimental farm plantation should consist of under the management of the County Council in connection with agricultural farms?—Well, it is difficult to get an idea of that, because these experimental farms are put down on land which is not forest land. I do not think they would need much land, say 10 to 20 acres of land, which one cannot say is essentially forest land, for the purpose of putting down these demonstration plantations. I should like to see something like 100 to 120 acres, if suitable land could be obtained. But you can do a great deal with even 20 acres.

3056. Do you think it would help if the University authorities in centres where forestry instruction is given would recognise the lectures and the examinations which would be consequent upon the lectures as giving the students a certain amount of credit, which would help him in taking a degree, or which would be of assistance to him in one of the other schools?—They allow the student to select forestry for a degree in Edinburgh now. The subject is a compulsory one in the University of Durham for the degree of Bachelor of Science in Agriculture.

Dr. W. Somerville.

6 May 1902.

3057. That is not the case at Cambridge?—No, that is not so in Cambridge, and I did not see my way to urge it. The subject was only recently started there, and there were other subjects which had a prior claim, it seemed to me. And it does not at present count as a subject for the degree. But it is only a question of time. It will eventually be brought in, I have no doubt.

3058. If it were brought in I have no doubt it would encourage the study of forestry?—It must necessarily do so.

3059. But naturally University men who have only a limited time to spend there look to the subjects which it will pay them to follow up?—Clearly.

3060. Are there any suitable text-books, books in a clear and simple form, which could be easily understood by foresters who are unable to attend the lectures? One would, I suppose, make a complaint of the dearth of text-books of that character?—The amount of forestry literature in this country is not great. There are some very first-class manuals, but they are perhaps rather beyond the reach of the ordinary working forester. Very valuable articles appear in the Transactions of the two Arboricultural Societies.

3061. The ordinary forester has not access to these Transactions, has he?—Yes, there are large numbers who have, and the two societies allow foresters in at reduced rates.

3062. Do you think it would be an advantage if information of that kind were given in a small and permanent form to foresters who could not afford to attend the classes?—I clearly see the benefit of having such a book. Indeed I would not like to say positively such a book does not exist at the present time. I do not recollect one which one could call a primer of forestry or an elementary text-book on the subject, unless there is one in America.

3063. Do you agree with other witnesses that there are considerable areas of land in different parts of the country that could be profitably afforested, but which are not at present under wood?—Yes, I am clearly of opinion that that should be done.

3064. Do you think it would be an advantage if a small expert committee were appointed for the purpose of ascertaining more clearly and definitely where there are such areas, and the extent to which they might be planted?—I think that such information would be of very great value.

3065. With the view of possible State action in the future?—It would be very desirable indeed that a more clear and more authoritative statement should be obtained as regards the areas which are likely to be suitable. We know the areas which are not at present under trees, but we do not know what proportion of this area may be suitable for tree planting. I think such a committee would be very usefully employed.

3066. (*Dr. Schlich.*) I shall not have very much to ask you, for two reasons; first, because you have already been examined upon a variety of subjects; and, secondly, because you have declared that you are in agreement with the proposals put forward by Colonel Bailey as regards Scotland, and by myself as regards England. But there are one or two questions I should like to put with the view of eliciting additional information. The first is, what is the extent of the forestry instruction which you used to give at the Durham College of Science?—I tried to give a review of the whole subject, what the Germans call "encyclopædie."

3067. Consisting of about how many lectures in the lecture room?—About thirty hours' instruction.

3068. And was that accompanied by any excursions or not?—It was accompanied by a certain number of excursions.

3069. You had not any great means of instruction in field work near Durham?—Yes, we were rather well off in that respect there. We found a much greater difficulty in Cambridge.

3070. I must ask you the same question about Cambridge, about the extent of your lectures at Cambridge. Did you give them to about the same extent as at Durham?—The course at Cambridge ran to more. In this way, that whereas at Durham I used to give instruction in forest botany and forest entomology, at Cambridge I was relieved of these two subjects. One was taken by Professor Marshall Ward, and the other by Mr. Warburton, the University lecturer in entomology. So although I continued to give 30 hours' instruction, as I was relieved of those two subjects, the course was more complete.

3071. In other words, you gave your instruction in Cambridge to rather more advanced men?—Yes, I think so.

3072. What is your idea with regard to the educational facilities provided at Oxford and Cambridge? What was the extent of that instruction? Or I will put it in another way. You are counting at Oxford or Cambridge on a number of owners of land, and first class or superior land agents?—Yes; that is the class.

3073. What do you think, from your knowledge of the arrangements at Cambridge, would be a sufficient amount of instruction to students of that class?—Well, we have to remember that these men are burdened by other subjects, and one cannot indicate what one would like, so much as what one can get.

3074. Precisely?—I should say that under existing circumstances the case would be met by something like a 50-hour instruction course annually in forestry, in its more restricted sense. The students get instruction in botany and geology and chemistry, and all such subjects, outside of any possible lectureship in forestry. I think probably, to begin with, that would be sufficient. In fact if one were to make the course too elaborate one would deter some from entering.

3075. One other matter I would like to clear up. Do you not think that we ought to strive to obtain, at any rate at one of the Universities, rather a more complete education in forestry, with the view of meeting the case of those who want to devote themselves specially to forestry, whether they work in this country, or go to the Colonies, or, might be, go to India?—My view is that men who want to specialise to that extent ought to go to Coopers Hill.

3076. With regard to the men available for instruction under the County Councils, if we were to introduce a more extended system of instructing through the agency of County Councils, we should require a considerable number of instructors?—Yes, one would require a considerable number, but I should not think of attaching an instructor permanently to any one County Council, or to any small group of County Councils. The County Councils might employ qualified instructors, who might of course be in one part of the country at one season and in another part at another season.

3077. And that might fit in, or it might not? It might be desirable in many cases that the instruction in different counties, or in different places in the county, should be given at the same time, that is, when it is most convenient for the men who are to attend it. I do not say it would be so. And then the number of counties is very considerable. What I want to know is, do you not think there is room for the education of a sufficient number of competent men as instructors under the agency of the County Councils, and ought we not to take into consideration that fact in devising means for instruction in forestry at what I may call headquarters?—You mean that the preparation of teachers should be an important item?

3078. Yes?—I do not think that the number of teachers who would be wanted in this country can ever be great, and especially so if we are going to concentrate our efforts ultimately on two or three forest schools. But, of course, the instructors who take agriculture or rural economy as a general subject ought to have some knowledge of forestry also, as being a portion of estate management.

3079. As to the development of means of instruction at Cambridge, I think you could tell us something about the land available, either for a forest-garden of some considerable size, or if necessary afterwards, for a small school forest. I think possibly you might be able to tell us something about the land available, and the ordinary rates at which such land is nowadays let within a reasonable distance of Cambridge? Have not some of the colleges considerable areas of land?—The colleges, of course, have large estates, and to some extent these estates lie near Cambridge. There is no considerable area of wood on any of them which I am acquainted with.

3080. It is perhaps agricultural or pastural land now. Could that be made available?—There is plenty of land which one would call suitable forest land, the rent of which for agricultural purposes in many cases is no more than 5s. an acre.

3081. That is what I want to know. A fairly large area could, if necessary, be made available, you think? —I think so, but there is a great difficulty about the extension of forestry in the East of England, and that

Dr. W. Somerville.

6 May 1902.

is through the tithe, which is high in Cambridgeshire and Essex; in many cases it is 4s., and sometimes 5s., an acre.

3082. You mean if it is to be forest?—No, at present the land is loaded with tithe to the extent of 4s. or 5s. an acre; and that tithe will, of course, remain.

3083. That would be in addition to the rent?—Yes, in many cases it is.

3084. And that would bring it up to 9s. or 10s. an acre?—That is so in many cases.

3085. Even on 300 acres that would involve in the shape of rent £130 to £140 a year?—You could get plenty of land for that.

3086. I want to ask you another question, based upon your experience, and we know you have had a considerable amount of experience. Do you think that the damage done to forests, generally speaking, by diseases such as fungi, or the damage done by insects, is the greater? I mean which damage is the greater of the two, looking at the matter all round?—If we exclude larch disease, there is no difficulty at all about answering your question.

3087. And the answer is?—The answer is insects; these do far more damage than fungi do.

3088. Far more?—Yes, far.

3089. You know as well as I do that in continental forests they say that for every tree that is ruined by a fungus there are perhaps five or ten trees which are ruined by insects. We need not go to quite that proportion, but you are satisfied that the damage done by insects in the long run is by far the greater?—I think so.

3090. Consequently the importance of the study of entomology would not be inferior to that of the study of fungoid diseases, for the working forester, and perhaps might be of more importance?—Quite as important, yes.

3091. Perhaps you will be good enough to tell the Committee one thing more. So far as our knowledge goes at present—and it is not by any means a closed book—what would you say was about the number of fungi which are really actually dangerous at present to forest growths? I mean those which really come into consideration from the point of view of managing a forest?—I suppose something under half-a-dozen.

3092. And at what number would you put the injurious forest insects—I mean those of the first order, corresponding to your half dozen fungi? Somewhere about the number 100 or 50?—It is very difficult to say.

3093. It is a multiple?—No, it is not very much of a multiple. I should not think the number of species is very much greater than half-a-dozen.

3094. Do you mean of forest insects?—Yes. The number of species of forest insects which do serious damage to trees does not seem to me to be much beyond half-a-dozen; but the aggregate damage which is done by these insects is very much greater than the aggregate damage which is done by the half-dozen important forest fungi.

3095. I am surprised you have put it so small. I was prepared to hear you say fifty or lower, but I am surprised to hear you put it as low as six?—We might pursue the matter a little further, and I might name them.

3096. Can you do that?—My point is that a very large number of extremely interesting forest insects do not attack healthy trees, and do not attack living trees, and if you confine yourself to insects which attack healthy, living trees, the number of them is not a very large one.

3097. I am satisfied with the answer which you have given me?—I think, speaking about fungi, that the most unsatisfactory thing about diseases of trees is that those caused by fungi are such that one can do very little to stop them; but in the case of damage caused by insects one can do a great deal to combat it.

3098. I intended to ask you that question. You say you can do a great deal to prevent the extension of insect damage, and far more readily than you can the damage caused by fungi?—Yes.

3099. (*Colonel Bailey.*) In connection with the County Council lectures, which I am interested in myself, because I have just come from attempting to give such a course, I would like to ask you one or two questions. If I understand you aright, you suggest a course of some twenty-five to fifty lectures?—I think a very suitable number would be one lecture a week for about tw winter weeks, and that would be twenty lectures.

3100. At what time in the day were the lectures given, of which you speak?—They were given in the evenings. That is the only time at which you can get the working forester into a class.

3101. I think you said the instruction was combined with excursions?—Yes.

3102. When were they held?—On Saturdays.

3103. In the afternoons?—Yes, afternoons for the most part.

3104. You say the attendance at the classes at Hexham was about twenty or thirty?—Yes.

3105. And you have there, I understand, a large number of nurserymen, owing to the presence at Hexham of considerable nurseries?—Yes.

3106. You mentioned the possibilities of having such lectures at Perth, Aberdeen, and Inverness. Do you think that you would be able to assemble at those places the class of men that you want for such a course as you have been speaking of? I mean the working foresters? I ask this question because it is a difficulty which one has to face, and I do not see my way out of it. You may have an audience, but are they the right sort of men?—I agree that in some cases that may be; but in my experience only a small proportion were not working foresters.

3107. From the nature of the foresters' duties they are people who are scattered about. They live probably in the most remote districts, and I have never been able to see my way to the assembling of a satisfactory number of the kind of persons that I want to get at. I gave a certain number of lectures at Torphins, and the room was fairly full of people, but I think that the people I wanted formed a very small proportion of the audience. Consequently the amount of good done by a course of lectures such as I have attempted to give must be relatively small. The course might certainly excite a certain amount of interest and give some useful general information to school children and others; but as to it being a serious attempt to deal with the education of the forester, I have considerable doubts, and I want to ask you whether you share those doubts?—A large number of foresters attempt, at some stage of their careers, to put in a year or two in a public nursery. I think that may be accepted as part of their training, as a rule. And those young men who come to such a place as Hexham or Inverness would naturally take advantage of the opportunities for scientific instruction which might be presented. In the neighbourhood of these places there are woods, and within a radius of ten miles or so there may be a considerable number of men engaged in the practice of forestry.

3108. So that the presence of a nursery would be a very important feature in the success of such classes?—Yes, because it attracts these young men.

3109. You think it would be an important feature?—Yes.

3110. But if you tried to give lectures in a place where there was no nursery you would not be likely to meet with so much success? There would be a great difference?—I think if there were no attraction of that kind your class must be very small.

3111. Would it not be very difficult, under these circumstances, to organise the peripatetic lectures which we have talked about? The lectures can only be delivered in the evening, and very probably, as Dr. Schlich has suggested, only at a certain time of the year. Would it be possible for a lecturer to go about lecturing one night a week? Could you find lecturers who would cover very much ground in that way? Would you not require a considerable number of lecturers?—The number of places which are suitable for such instruction would be very limited. Perhaps the number of suitable places in Scotland would be four or five, apart from Edinburgh, and there would be nothing to hinder one expert, or one forestry lecturer, dealing with three such places in a week.

3112. Then you do not contemplate the extension of this system all over the country? You say it would be only applicable to four or five places?—That is as regards local lectures. But with regard to other lectures, where you get men coming in from a radius of thirty miles, the matter might be different.

3113. I thought that was all one thing. I had not realised there were two?—Drawing from my own expe-

Dr. W. Somerville.

6 May 1902.

rience, there is such a centre as Hexham, with forests and nurseries in the neighbourhood, and young men coming up to learn the business. Then there is the other case where we got men to come into Newcastle from the counties of Durham and Northumberland, as they would come into Edinburgh from eight or ten miles round, or any place which was accessible within two hours by train. And the County Councils in the North of England were giving scholarships of a value which covered the railway expenses of the pupils.

3114. Taking Scotland as a whole, could you give us an idea as to how many centres, in your view, should be established? Or how many centres do you think it might be possible to establish?—I think it would be desirable to see more instruction given in the University of Aberdeen; and I think, as regards permanent centres, that such centres in Edinburgh and Aberdeen would meet the case.

3115. Some, including myself, have held the view with regard to Scotland that it would be a mistake to begin by scattering our efforts; that we should begin with a well-equipped educational establishment in one centre, and then gradually develop as required by the evolution of things. What do you think about that?—I think that a considerable number of men are at present going through the agriculture course in the University of Aberdeen, and afterwards going out into the world as estate agents, and they are receiving there whatever scientific instruction they will ever get, and thus the one opportunity of giving them instruction in forestry has been neglected.

3116. You said that there were a considerable number of men, as I understood, who might be availed of for the purpose of giving instruction, and that these men had had courses of instruction in this country, and had afterwards gone to Germany?—Yes.

3117. But there are no schools in this country, except at Coopers Hill, at which such instruction is given?—There are a few who have been through it.

3118. I am myself conducting one of the largest courses of instruction outside Coopers Hill, but I do not claim that any man I could turn out from my class would be competent to teach?—I was careful to say that there were men who had gone through all the instruction which they could get in this country, neglecting Coopers Hill, and who had subsequently gone to the Continent, and had gone through a complete course of instruction there.

3119. Do you think that men who have merely gone through courses of instruction, but have not had practical experience, are competent to give instruction?—They are competent to give instruction which is of value, but not so much so as if they themselves had managed for, say, seven or eight years a large forest area.

3120. You mentioned the establishing of demonstration plantations in connection with agricultural classes, plantations of 10 or 20 acres. Who would look after those?—The Director of the Agricultural Department of the College who had charge of the farm.

3121. He would be an agriculturist, but would not necessarily know anything about forestry?—I do not suggest that these should be developed unless there were expert knowledge sufficient to do it.

3122. You need not necessarily rely upon the agricultural teacher for it?—No, not at all.

3123. I have only one more question, and that is with regard to the present salaries of foresters, which, I daresay you are ready to allow, are very low in proportion to the value of the interests committed to their charge?—Yes.

3124. Do you think that if the system of forest education which we have been talking about were developed that would in all probability lead to the realisation by the landowners of the value of their wooded property, and consequently to an improvement in the prospects of working foresters?—Yes, I think so.

3125. And you think that if that were so it would possibly lead in the future to their being taught at some of the higher educational institutions?—To some extent it would do so. Of course we must be very careful not to attempt to prove that foresters are going to get more salary, and that therefore the estate is going to be weighted with heavier charges. I would make this point: that probably in the future the forester may have greater responsibility placed upon him, and will probably therefore get a higher remuneration; but the money which is required to pay this improved salary would be saved in some other direction, or by some other department of the management of the estate.

3126. (*Sir John Rolleston.*) You agree that the principal person to be influenced as to the importance of increased attention to forestry is the landowner?—Yes, I think so.

3127. He is the first person to be thought of?—If one had only to attend to one section of the community I should begin with the landowner.

3128. You think, from your experience, that forestry is a subject which does appeal to young men who are prospective landowners in the position of undergraduates at the Universities?—Yes, I am quite clear upon that point.

3129. And that better opportunities for instruction would produce that increased interest which is desirable?—Judging from my own experience, one can always get an audience if one can provide the subject.

3130. On very poor land it pays better to produce timber than food?—On very poor land, yes; better than farm crops.

3131. Timber production must be on a large scale; there is no room for a small holder in the production of timber, is there?—Not for a very small holder.

3132. With regard to damage caused by insects, is that damage increased, do you think, by bird destruction?—I cannot say that I have formed any clear opinion on that subject. But I am not aware that the destruction of bird life has materially increased the damage caused by insects.

3133. (*Mr. Marshall.*) You have touched in your evidence upon the question of attracting students to the classes—that is to say, the working forester class. I should like to ask you how you propose to induce the County Councils to give facilities?—The County Councils, in my experience, have been always very ready to give opportunities for instruction if instruction is called for.

3134. Of any sort? Do you think they would take forestry in?—Yes, I think so, if there were a demand for it, just as they teach carpentry, and so forth. If the County Councils were asked for instruction in forestry I think they would no doubt cast about to provide instruction in it, just as they do also in horticulture.

3135. You do not think they would need much persuasion to do that? I gather much was done in forestry in the north of England simply because you were there to advocate the claims of it. Do you think the County Councils would want an equal amount of persuasion all over England? I am talking particularly of the south of England, where foresters are certainly twenty times as ignorant as your people are in the north of England; there are a few Scotch people who know something about it, but there are very few in the south who know anything about it, and consequently they are absolutely in need of more education by a primary course than other people are. Do you think that County Councils all over England would be prepared to take it up?—Nearly every county in England is now in contact with a collegiate centre. In the south of England there is Reading, which covers a large number of counties in this respect; and if the contributing counties to Reading were to demand that the Agricultural Department at Reading should provide a system of instruction in forestry I think it would be an advantage, and there would not be much difficulty.

3136. Would they be induced to provide scholarships as well?—I have never known County Councils backward in coming forward with scholarships if they could get anyone to take them up.

3137. (*Dr. Schlich.*) You laid special stress on the financial aspect. I think you said something to this effect: that the financial aspect, in the last resort, would govern the whole question?—I do think so.

3138. Is it not of the first importance, apart from Natural Science and Natural History, that foresters should be especially instructed in those branches of forestry which tend towards more favourable financial results, such as sylviculture, the treatment of growing woods, the collection of statistics, as to which are the best methods of treatment of the diseases which attack trees, the question of rotation, and so on? Is it not of the first importance that students of forestry should be specially instructed in those branches?—Yes, I think

Dr. W. Somerville.

6 May 1902.

so. In many cases it is not the working forester who determines these things, or who influences the course of things.

3139. But those men who are really to guide the whole of this business, and who ought to be the foundation of the thing, ought to be most thoroughly instructed in those particular branches?—I think so.

3140. You agree with me in that?—I do; and I would add one more matter. If the success of a forest area is going to be gauged by the financial results, we must take very great care that the section of the scheme which deals with instruction and research is kept distinct from the general working plan of the forest area. That is to say, a certain sum must be carefully ear-marked for the purposes of instruction and experiment, and shall not be merged into the ordinary working expenses of the forest. If we do not make that distinction we shall, of course, find it absolutely impossible to show a respectable return upon the capital invested, and we shall be very liable to be met with the charge that, even under the so-called scientific system of management, forestry has not returned the interest which people expect.

3141. In other words, you propose that a separate account be kept of the actual management of the forest, and a separate account of experiments in that direction?—I think it is of the utmost importance that that should be done.

Mr. C. O. MINCHIN (Inland Revenue Department), called; and Examined.

Mr. C. O. Minchin.

3142. (*Mr. Minchin.*) Before you begin to examine me, sir, I would like to be allowed to say that on the first page of the statement I have supplied (*Appendix XV.*), which was prepared rather hurriedly, there is a word which might be rather misleading. That is, in the third paragraph, two lines from the bottom of the page. It says: "In order to arrive at the net income 'necessary outgoings' have to be allowed." I think probably "proceeds" would be a better word than "income" there. I am not referring there to annual income, but to the deductions which would be taken from the income; that is to say, the gross receipts arising from the felling and sale of timber.

3143. (*Chairman.*) The point I want to ask you about is rather in connection with the Finance Act of 1894, and the succession duty. With regard to Section 7, you quote a clause which limits the valuation of agricultural property on which the death duty is levied up to the extent of the superior limit of 25 times the annual value?—Yes.

3144. According to my recollection—I have not had time to look up the debates—that clause was intended to limit the death duties on woodlands to 25 times the annual value as assessed under Schedule "A" of the Income Tax Acts. But I observe that the interpretation of the Inland Revenue Department of the Act as it was passed was, that the capital value of all timber on the woodland should be included?—For a moment it was so.

3145. That is to say, that every stick on the ground was to be valued?—The idea was at first that the provision applied to agricultural property, including merely what one generally calls agriculture—tillage, and pasture, and such like—but did not touch such things as forestry. That was the floating idea in the minds of some of us at the time, but only for a short time.

3146. You valued ripe timber, in addition to the 25 years' purchase of the pastural value of the land?—Yes.

3147. That, I suppose, was found very difficult to define?—Of course, that would naturally require a most careful valuation in each case. But as regards the concrete result, I do not know that there was any case in which it really was applied, at least in any case of importance. I have not succeeded in laying my hand upon a case of importance where that rule came in.

3148. The third system, the system now in force, is that where the agricultural estate is not valued up to the superior limit of 25 years' purchase; if an estate is valued at 25 years' purchase, no value is put upon the timber?—That is so. One of the concrete examples I give will show you that. I do not know whether you have been given those examples?

3149. Yes?—One of them exactly takes up that point, namely that marked B. No. 2. There there was a considerable amount of very valuable wood—I do not know whether it was technically timber—but all that was brought in was the value of the surface; 228 acres at the annual value of only £67, which is 7s. 6d. an acre. That was considerably below the average value of the property as a whole, and that is all we got for that 228 acres, including the timber, £1,686, which is £67 odd, multiplied by 25.

3150. So in a prosperous agricultural district, where land sells at 25 years' purchase and over, there is no death duty upon the timber itself?—Practically none.

3151. On the other hand, if you do not get 25 years as the valuation for an estate, you make up any difference between the 25 and the lower valuation by the value of the timber?—Yes. The Act says that the value of any property is to be taken as the price which, in the opinion of the Commissioners, it would fetch if sold in the open market. If property were sold in the open market as a whole, the timber would be sold too. When an estate is sold, even by auction—I do not know how it is in the north—it is the universal practice in England to sell by auction subject to an agreement to take the timber at a valuation.

3152. But if agricultural land is sufficiently well situated to bring 25 years' purchase you do not value the timber?—No. There is no question then as to the timber. All we have to ascertain then is that the property-tax assessment of the woodlands is sufficient.

3153. Is there any reason why the woodland should not be taxed in the case of the land reaching as much as 25 years' purchase?—Yes, because the woodland, in the case of the land not reaching 25 years' purchase, would be itself taxed, but not the timber beyond the 25 years' purchase.

3154. My question was: Is there any reason why the timber should not be taxed in the case of the agricultural land reaching its 25 years' purchase?—Yes, the proviso that brings woodland into the description of agricultural property, because the woodland comes into the definition of agricultural property. That, the Commissioners are advised, puts the superior limit, above which they cannot go, so that they must treat an agricultural estate as a whole, with everything else that is in it.

3155. I understand. If the agricultural estate is valued at 25 years' purchase as a whole, then the only value brought in for the woodland part of the estate is 25 years' purchase of the unimproved pastural value of the land upon which the timber is grown?—That is so.

3156. But there would be nothing charged on the timber itself?—If I may say so, we are using the word "timber" now in rather a loose sense. Timber, in a technical sense in England, only means a very few species of trees, and those of upwards of 20 years' growth, and growing on their own foot. That is the legal definition of timber.

3157. Well, we will say woods and plantations?—But where we use the word "woods" generally, that affects assessments and the annual value. A plantation of old oaks growing on their own feet would be valued in a different way from plantations of oaks which were growing in stools and springing up as saplings.

3158. But that is for the valuation of timber apart from land?—For the annual valuation for rates which the Property Tax follows. Perhaps, if you will allow me to quote the words of the Rating Act it will be useful: "If land is used only for plantation or woods, the value"—this is the annual value—"shall be estimated as if the land, instead of being plantation or a wood, were let and occupied in its natural and unimproved state." I will tell you afterwards what the legal definition of "natural, unimproved" is. "If the land is used for growing saleable underwood"—and that practically means timber grown on stool, although it may be 32 or 36 years old when cut—"the value shall be estimated as if the land were let for that purpose." And if the land is used for both, it is

Mr. C. O. Minchin.

6 May 1902

left to the discretion of the Committee. Land in its natural and unimproved state may be of very small annual value for occupation purposes. In a case which came before the High Court the land, if in that state, was shown to be fit for only very rough grazing—coarse grasses, ferns, etc.—and the judges approved the assessment as amended by the justices at quarter sessions, which put the annual value at 6s. per acre.

3159. Twenty-five years' purchase at 6s. an acre?—Yes.

3160. Let us take two estates in a poor part of the country, where land could be bought at 20 years' purchase. Suppose that on the one estate there is no wood, but on the other hand there was a large timber area. In the one case, I assume, from what has been said, that you would only get, under the death duties, a valuation of 20 years' purchase for the land. On the other estate, where there was a large timber property, you would raise the value to 25 years' purchase, so long as there was sufficient timber value to enable you to get it?—Yes, that is so.

3161. So that in that case woodland would bear 20 per cent. death duty?—The timber. The wood would bear it.

3162. Five years death duty on the whole estate?—Yes, but that probably would not be unless there were a great deal of well-grown wood.

3163. I will put another case. Compare an estate in one of these poor counties, with an estate in a prosperous county. You might have an estate in a prosperous county where the 25 years' purchase was easily got with a great woodland area. The whole of the timber on the whole of that woodland area would escape death duty? On the other hand, on the estate in the poorer county, the large woodland area in the case which I have given—20 years' purchase—would have to bear a five years' purchase of the whole estate, so as to make it up to 25 years; the consequence being that in a very prosperous county estate woodlands would escape any deficiency that had to be made up, whereas the poorer the county and less the valuation the more heavily would woodlands be taxed to make up the deficit?—Yes; that is, poorer as regards value of bare surface; it is not the poorer estate.

3164. I will put it in another way. The land in the county where the land valuation stood high, under wood, would only bear death duty upon its unimproved capital value, and no duty would be levied upon the timber, whereas in a poor county you would not only rate the woodland area at its unimproved pastoral value, but you would rate the wood which is grown upon it for death duty?—Yes, that is so.

3165. I want to show how it works out under the present system?—Yes.

3166. In Ireland, I believe a very common rate at which estates are returned for death duty in Ireland is 18 years' purchase?—Yes; and that is high, except in a good county.

3167. Let us say 16 years' purchase?—In a bad county, yes.

3168. Take it at 16 years' purchase. Suppose anyone in a bad county grew a valuable timber area; there would be nine years' purchase to make up to the 25 years, would there not?—Before you arrive at the limit. But I do not think anyone would plant timber in a bad county in Ireland. It is my own country, and I know something about it.

3169. But unless there were a special Irish clause, logically you would have to?—Logically one would have to do that, unless there were a special remission made.

3170. You would, I think, find great differences in valuation if you took an estate in a crofter district in the west of Scotland, and an estate in the Lothians? You might find, I should think, some estates in the crofter district in the west, where shootings are not very valuable, which could be bought at 18 to 20 years' purchase; and in that case the balance would have to be made up by the wood, if there was any?—Yes.

3171. Therefore, the superior or maximum rate of valuation, this 25 years, is converted into a minimum rate, so long as there is sufficient timber upon the estate?—I do not follow.

3172. The 25 years' annual net value of the land is called, I think, the superior limit, is it not?—Yes. That is simply a figure which is arrived at arithmetically. There is nothing of the merits of the case in that; it is simply an arithmetical calculation. That shows you a value above which the Commissioners must not go, although the intrinsic selling value of the estate is greater, and even though it may be actually sold. Still, the Commissioners are limited to that if the property is agricultural, and if there is no hope of increased income. The hope of increased income of course might affect a timber estate; it might be possible to say this price is given by the man who is buying it because he knows that by working this as a timber estate he can get more out of it than is being got out of it at present. I do not think that has occurred, but it is conceivable that it could occur, and then the superior limit would be removed, and the Commissioners would be free to value according to the price paid.

3173. Then you go back to your first system?—Yes, to valuing according to the price.

3174. And this superior rate, beyond which you cannot go, unless there is building value, or mines, or anything of that sort on the land, is the maximum rate of valuation. But this 25 years is converted by the valuation of timber, so long as there is enough timber on the estate, into a minimum rate also. It must be 25 years so long as there is enough timber to stand the valuation?—Yes, as long as there is enough timber to bring it up to that.

3175. And, therefore, the maximum rate valuation is converted into a minimum rate; that is to say, you never get less than the full value?—Never, unless the estate, by reason of the quantity of timber, is intrinsically worth more. In that case you may get a good deal less, in spite of the timber.

3176. (*Dr. Schlich.*) I want to ask you one question in continuation of what the Chairman has put to you. The timber which is standing on the estate is utilised, so to say, you bring up the original estimate to 25 years' purchase. Suppose you have rated it at only 20 years' purchase, and then there is a quantity of timber on the ground, you can utilise that to bring it up to the upper limit of 25 years' purchase?—Yes.

3177. Is not that putting a premium on cutting away the timber and converting it into cash?—No; it is death duty, you see. And, of course, if the owner cuts the timber and keeps the money, then the money would pay the duty upon its full value at his death.

3178. If in his lifetime it is divided amongst his children, is it not likely to act as a premium on cutting timber rather than leaving it until the proprietor's death?—I do not think so.

3179. It appears to me it might act like that in many cases?—I think it does act as a premium on cutting timber after the owner's death.

3180. Yes, to pay the death duty, I know that?—Yes, but not in his lifetime.

3181. (*Mr. Stafford Howard.*) Does it often happen in practice that you have to resort to the timber to make up the 25 years' purchase?—Oh, yes, frequently.

3181.* And in a good many estates which are not valued at 25 years?—There are many estates which have a certain amount of wood, and they come on at the average price of land in a fairly good county, and that would be 23 to 24½ years' purchase. Then we look into them rather carefully, and if we find there is a good deal of woodland we question the owners as to that. They perhaps say, "Yes, there is a lot of wood, and we did not trouble to value it. Fill it up to 25 years' purchase, put down so much, and ask no further questions." That is a thing which very often occurs in both large estates and small. And that is for the reason that many estates in England are brought before us as being of the value of 24 years' purchase—rather more or rather less.

3182. And you always assume that they are worth 25 years, and the other parties have to show that they are worth less?—No, we go into the merits of the case according to the local markets. We never assume anything.

3183. But it has the effect, as the Chairman said, of making it a minimum?—Yes, in that class of case it has.

3184. (*Chairman.*) Can you say offhand what, on this side of the water, the valuations of landed estates are? What is the minimum number of years' purchase on landed estates on which they are valued for death duties?—It depends very much on circumstances, because there are many old estates that keep up the old rent-book, which may have been the last owner's; and although they never collected that rent in full, but gave some of it back to the tenant, or did not draw it all from him, or paid for extra repairs, or gave him so many loads of manure, still the old rent-book stands. And so long as it stands it is hard to get the local people to

Mr. C. O. Minchin.

6 May 1902.

drift away from it for assessment, and so the local assessment is kept up. For that reason there are many estates, especially old estates, where the value would come in at 19 or 20 years' purchase. I have seen several large estates returned at 19 and 20 years in bad counties.

3185. That is on imaginary rental?—That rental would be on an assessment which is out of date—probably too high—and if we could get a property tax corresponding to the annual value it would be 24. We have to put up with what the local people say. It does not always stand the test of sales in adjacent districts.

3186. Are there many estates in the poorer counties in this country which, on the real rental, would be valued at 20 years' purchase?—In some counties there are, and in some parts of counties. There are districts in Wessex and part of Yorkshire of that kind, but I think they are going up now. A few years ago I think 20 years' purchase was about the price.

Mr. A. D. Webster, called; and Examined.

Mr. A. D. Webster.

3187. (*Chairman.*) You are nominated, I believe, by the Royal Horticultural Society to give evidence?—Yes.

3188. And you propose to give us your views on re-afforestation, not only here, but in Wales and Ireland. Ireland, of course, can always be touched upon, but it is outside the scope of the present inquiry. We shall be very interested to hear your views on re-afforestation of the forests in this island?—My views are that a very great deal might be done. Our timber supplies are very limited at present, and there are several inducements to very extensive planting. One of those reasons would be the abnormally high price of timber at present, and chances of a timber famine. I think also that by the establishment of a few schools of forestry a great deal might be done by carrying on planting by the Government at the same time as the education of our foresters was being attended to. Students of forestry, perhaps, after they have served an apprenticeship of three years under a competent forester, would finish off, as it were, by going to one of the forest schools, which would be established in connection with the planting of some of these waste lands. A good deal has been said to the effect that it is difficult to establish plantations on exposed hillsides, but I have much evidence to prove that plantations have been very successfully formed, and very valuable timber has been grown at considerable elevations on exposed hillsides in Wales, and also in Ireland. I was anxious to dwell upon some of the peat bogs in Ireland, of which I have had experience. I think much might be done in connection with the re-afforestation of Scotland and Wales.

3189. In which branch of forestry have you had most experience?—Principally in connection with the management of woodlands.

3190. In this country, or in Ireland, or in Wales?—In Ireland, and in Wales, and in England. I was for a number of years in Ireland, and there assisted in the formation of plantations, which reclaimed a good deal of peat bog. For ten years I was at Penrhyn Castle in Wales, where much hillside planting was engaged in. I have also assisted at afforesting in Scotland.

3191. Did you sell much timber?—A great quantity.

3191.* Did you find it pay well?—Well, on Lord Penrhyn's estate, particularly where plantations were formed with a view to their paying, it did. In many cases plantations are formed as coverts for game shelter. I think you cannot very well have game and timber, and work the two together satisfactorily. The plantations for game covert require to be thin; the trees are placed so as to induce the undergrowth for covert, and it is difficult to have trees and timber clean of growth when grown sparsely on the ground. So as to produce the finest timber you require to grow the trees thickly on the ground, much thicker than you would if game covert were the first consideration.

3192. You attach considerable importance to forestry?—Very great; I think it is very much neglected.

3193. How were you trained yourself?—I was for a number of years with my father, afterwards for two or three years on what I might call an apprenticeship. Then I was foreman on another property; and afterwards I finished off at a school in connection with forestry. I have done a great deal towards my own education in the line of forestry.

3194. Which school was that at?—It was a school rather in a private capacity; not a public establishment in connection with forestry. I have a scheme drawn out for the education of foresters.

3195. Do you think that there are many foresters who would be glad to have opportunities for instruction in forestry?—I think there are very many; but you cannot expect a forester, with perhaps an average salary of £100 a year, to be able to educate himself better than he does at present.

3196. I suppose he should be educated before he gets to the £100 a year line?—Yes, but how? How can you expect it for that salary? For £100 a year it is hardly worth while educating yourself. But I think if the idea I am bringing forward were adopted it could be done.

3197. What is your view?—It is this. If a forester spent three years as assistant on any property, and were then to go into a State forest, where classes could be attended, it would benefit him very greatly. Or if the Government were taking up the planting of these waste grounds, they could employ foresters who had already served their apprenticeship in another place, and who could assist in carrying out the work in the Government plantations, which would not only be a saving in their formation, but the forester would at the same time be finishing off his education. The scheme would be too long to give you here, but I think it would be a very workable one.

3198. You are thinking of it in connection with the State forests?—In connection with State forests, if the Government took up the planting of waste ground.

3199. Do you think you would train them in connection with the State forests?—The forester, after serving three years as an apprentice, would go to the State forest under a capable forester. The young or assistant forester throughout the day would possibly attend to his various duties in connection with the laying out and management of these areas for planting, and it might be that later on he would give attention to the converting of the timber. In the evenings, or at other times, he could attend lessons, which at present he has not an opportunity of doing. I think if six schools were established in various parts of England, Ireland, and Scotland, and were placed where the greatest amount of Government planting was going on, and that the pupils were afterwards to go on to the management of the forests, that would be the best way of educating our young foresters.

3200. Do you find that most land-owners and agents know much about the management of woodlands?—No; and I think it is a very serious drawback that so many of our great woodlands are entrusted to the management of estate agents, gardeners, and carpenters. I have in my mind several instances of woodlands which I have visited recently, in which great quantities of timber have been planted on the wrong class of soil. There are some very notable examples. I think a very great deal might be done if only competent foresters were engaged in the laying out and management of the woodlands.

3201. Under the present system of training there is a dearth of competent foresters?—There is, but there would not be if proper wages were given. But, of course, you can hardly expect a man receiving £100 a year to care very much about the profession. Many foresters have given it up, and have gone into other lines of life.

3202. Do you think it would be good if landowners and agents were trained also in forestry?—I do not think it is necessary.

3203. With regard to the disposal of home-grown timber, you have had experience of that?—Yes, I have had a large experience of that.

3204. Do you think that the quality is deteriorating, or that it is improving? I mean the home-grown timber?—I do not think it is deteriorating: I think it is rather improving; but I think a good deal more might be done in connection with the matter if a good deal of re-afforestation were going on. I think too that our present system of disposing of it is not good.

3205. How do you think we should dispose of it?—I think a great deal of the home timber might be used on the estate. There are notable examples where they have established sawmills to cut up timber for estate

Mr. A. D. Webster.

16 May 1902.

purposes. As a rule in the sale of the timber the timber merchant has the best of the bargain. I do not mean that all the timber which is used, say, in house building should be or could be grown on the estate, but I think very much more might be disposed of in that way than is at present the case.

3206. Do you think most foresters are competent to deal with the manufacture, and valuation, and transport of timber?—Not at present.

3207. They want to be trained in that also?—They want to be trained more on the scientific side, I think. On the practical side they are able to manage, but they cannot afford to finish their education as they should. I think by establishing these State forest schools, schools at the expense of the State, there would be a training which would give a very much better education than at present.

3208. Have you managed woods which were devoted exclusively to timber without regard to game, or ornament, or show timber?—I have managed those which were in combination; where the timber was for disposal, and also for game covers. On the Penrhyn estate the timber, in certain districts, is grown, and the plantations are managed in view of game as well as for the timber. It is a difficult matter to work between the two.

3209. (*Mr. Stafford Howard.*) You were in Wales 10 years?—Yes.

3210. Did you plant much?—Yes, a good deal, on the Welsh hillsides.

3211. In what parish?—In Llandigai and Llanellechid.

3212. You mean just above Bangor?—Yes, at 800 to 1,000 feet altitude above the sea. I formed the largest plantation of larch principally, although there was a good mixture of Corsican and Scots pine along the margins.

3213. Those plantations have done well?—They have done remarkably well. Previously to the planting of those hillsides nothing could exist on the slopes but the hardiest mountain sheep; it was quite a wind-tortured place. But now, with the establishment of plantations, cultivation has gradually crept upwards, until now at the base of the plantation the farmer is able to cultivate farm crops; and he can keep mixed stock, whereas previously the hardy Welsh mountain sheep alone could survive. It has done much good in that way.

3214. But that was where Lord Penrhyn had the whole of the property in his own hands?—Yes.

3215. There were no rights of common; he was not merely Lord of the Manor, but he owned the farms as well?—Yes.

3216. Therefore he could do as he liked with it?—Yes, the rental of the ground, previous to the planting, was about 5s. per acre.

3217. In connection with the sheep farms?—Yes, I think that is one of the most notable examples of the good that a plantation has done, in affording shelter on a farm that I know of.

3218. How many plantations?—There were several, varying from 100 acres to 30 acres.

3219. Would there be 300 acres planted altogether?—On the Penrhyn property, yes; not planted by myself. But there would be a much greater area than that on the hillside.

3220. On what you call the wild hillside, how many acres of plantation would there be there besides those you made?—2,000 acres perhaps, I should think; perhaps less, say 1,500 acres.

3221. What is the altitude of that?—From almost the sea-level to 1,000 feet.

3222. What I want to get at is, how many acres are there planted at the high altitudes?—At 800 to 1,000 feet?

3223. Yes?—About half the acreage, but not in one plantation.

3224. Scattered about?—Yes.

3225. When you speak about the State making these forests on the hillsides, do you propose that it should make scattered plantations of 50 to 100 acres here and there?—No; I think they could make a plantation of not less than 300 acres each time.

3226. Where do you suggest they should be made?—I suggest the range of Snowdon as a notable example, and in Merionethshire. I think there are very many vast tracts of country which would do very well for the cultivation of timber.

3227. Do you know anything as to the nature of the land-holding in that district?—Yes, I know it very well.

3228. Are you not aware that over the greater part of these hillsides there are common rights, which cannot be interfered with, except in the particular cases where, as in the one you mentioned, the holder of the land is also the owner, which does not always happen?—In most of Carnarvonshire, where there is very much waste land, you can plant if you like, but the Government can step in and cut down your timber on account of the minerals in the ground; but if the Government took over the districts, and the planting of them, that would not be likely to occur.

3229. But the Government would then have to buy up the whole mountain, and the sheep rights as well?—I suppose they would.

3230. You think it would pay them to buy up these high altitudes?—I think it would.

3231. From your experience on Lord Penrhyn's estate, that is?—Yes.

3232. And if it were done, it would be on a large scale?—I do not advise it for less than 250 or 300 acres. In the case of Lord Penrhyn's estate the plantations were to a great extent laid out for the sake of the ornamental appearance of the hillsides as well. That, of course, does not require to be taken into consideration so much as the laying out for the sake of the timber solely.

3233. If you are to have these highly-paid foresters and others to work under them, who shall carry forward a forest school as well as do the forestry work, it must be done on a large scale?—It would be necessary if you established a school of forestry in connection with large plantings. In Wales, that is to say in Carnarvon, Merioneth, or Denbighshire, where there are very large areas of waste land, these could be planted and worked as plantations, and the young foresters could assist in the management; I do not mean in the manual labour, but that they could oversee such things as fencing, etc. But no forester would be able, on the wages he gets, to pay for his education. That is the unfortunate part of the training in Edinburgh. In those schools you have to pay very highly to get the scientific side of the education, which would be done away with if what I suggest were carried out; that is, if the Government were to found schools in connection with the laying out of these plantations, and allow young foresters who had served three years to assist in the laying out of the plantations—that is to say, the superintending of them. They should be paid for their services, so that their education would cost but little, and the plantations would thus be formed better and at less cost to the Government.

3234. Have you any figures to produce in connection with these plantations at high altitudes?—No, I have not. I have such figures, but not here. In some instances the plantations have been too recently formed to allow of any profit for 20 or 25 years.

3235. But we could have the cost of forming them?—Yes, I could give that information, if necessary.

3236. If we could have those figures we should be glad, that is the cost of forming plantations at high altitudes; and we should like any figures of old plantations you have, as to the cost of maintaining them, and what they produced?—Yes.

3237. In that portion of Wales which you have referred to, and which you are acquainted with, you have not been over all the wastes?—Yes, I have been there, and I have been a good deal over the country in a professional way, so I am acquainted with many of the forests throughout England and Wales.

3238. I mean these big wastes in Wales. Is it in your mind that they might be planted? Would it be well to look at them for that purpose?—I have reported on them for planting already in connection with estate purposes.

3239. What places have you in your mind where State forests should be established? Where is there room to plant on such a scale?—I think that in almost any county you could get that.

3240. I am referring to Wales?—In Carnarvonshire, from Aber all along the mountain side to Ogwen Lake. On the hillsides there you could very well grow a good crop of larch.

Mr. A. D. Webster.

6 May 1902.

3241. Do you think sheep farmers would like to be taken from their holdings?—I do not think they would object to it, but they would be very much obliged for the shelter which is afforded by it. In a letter written to me by a farmer on Lord Penrhyn's estate, where a plantation was formed, he said it was a God-send to him and his stock, because on those hillsides the wind is almost unceasing.

3242. I quite agree with you with regard to a plantation for a shelter, but where you do it on a large scale you will have to occupy land which is now occupied by sheep graziers, and you must therefore get rid of some of those graziers?—But if you provided shelter they could have a better class of stock, because the small mountain sheep which alone survives here is not very profitable or remunerative, but it is the only one which will live on these exposed hillsides. But if a plantation were formed where the land could be grazed by cattle, which are more profitable than sheep to the farmer, he would do away with the sheep and take to more profitable stock. I have very little doubt of that.

3243. Your experience is that it has been successful in that part of the country, at all events?—Yes; apart from the value of timber produced, it has been a success as affording shelter.

3244. What is the aspect of these plantations?—All aspects.

3245. What is the aspect of the Penrhyn estate?—Varying, south-westerly; but at the Pass of Nant Francon it would be north, and larch has done very well; and on that pass the altitude is fully 1,000 feet.

3246. (*Professor Campbell.*) You have told us of your success on these wind-swept hillsides. What was the character of the soil there?—Well, in most parts, particularly on the Penrhyn side, it would be mostly loam, fairly good sandy loam. Of course, rock would be found cropping up every here and there.

3247. Suitable for tillage? Not exactly suitable for tillage. We plant at possibly higher altitudes than tillage could be engaged in.

3248. But the area under tillage crept up to the trees planted?—Yes, very often.

3249. So the character of the soil on this hillside was somewhat exceptional, was it not? What you say would not apply to many hillsides in England, Scotland, or Wales?—I do not know, but I think it would. I have been over many of the hillsides in England and Ireland, and the soil seems very similar to that in Wales. Wales, too, is like many parts of Scotland in the matter of the hillsides, and all would produce excellent crops of timber. Where my father formed several plantations, at Balmoral, for instance, the soil was granite, but you can see the success he had under such unfavourable conditions.

3250-51. Is there much land in England and Scotland that could not be planted, that would be too poor to plant?—Of course there is, but it is at much too great an altitude to plant. I do not think you could plant at a greater altitude than 1,300 feet.

3252. But below 1,300 feet the great bulk could be planted?—Yes, I think so; or you might say under 1,000 feet.

3253. It is not too poor, you think?—No, not if you properly choose your trees for it.

3254. (*Colonel Bailey.*) You speak of establishing a forest school in Wales, I understand, in connection with one of the areas which you would plant?—Yes.

3255. What kind of area are you thinking about in connection with a forest school?—Well, it would depend upon circumstances.

3256. What would you yourself wish to have? You said you would have 250 or 300 acres; but that would hardly be enough to establish a forest school?—If you could have several plantations of that size in close proximity, the forest school could be situated somewhere near.

3257. In reference to Mr. Stafford Howard's suggestion about the acreage which it would be possible to find in the country, if you could get several areas of the size you mention sufficiently near each other, you would be able to establish a forest school in connection with them?—I have no doubt of it.

3258. (*Mr. Marshall.*) These plantations which you told us about near Bangor, on Lord Penrhyn's estate, are they larch or Scotch fir?—They are larch, Corsican and Scots pine. Owing to the fact that it is such a wind-swept district we had to plant the particular kinds of trees which would stand. We had mountain elm or elder, and Austrian pine along the margin; we also planted many other trees, such as the Douglas fir, and these are growing there at a considerable altitude.

3259. I understand about the trees which you planted round the outside for your shelter belt, but what I want to know is, did you plant the conifers mixed inside?—Yes, mixed.

3260. Had you any larch there?—Yes.

3261. And what was your experience? That is, did you find mixed plantations were less liable to disease than pure plantations?—I would not say so. If I planted them solely for the value of the timber I would not mix them.

3262. You would not mix the varieties of larch?—No.

3263. You said, I think, that a good many foresters had been trained to forestry, but had gone into some other calling because the pay was not high enough?—Yes, I have numerous examples.

3264. But those men who went through the training, did they not know what they would be likely to get as foresters, and what wages would be offered them?—They might, but one generally expects to succeed well when setting out. There are a few good places in this country, and if you can get one of these you are very well off; if you do not get into one of these you must keep a lower rate of pay.

3265. And I understand that all these men were competent, as far as you know, to take such places; that they first of all got the places, and then they found they were not getting as much money as they expected, nor such rapid rises as they expected; and therefore they went to something else?—Yes, that is often the case; there is an example in myself. I left the best place in England to take up my present position, because I was not getting sufficient remuneration.

3266. A good deal of the evidence before this Committee has gone to prove that there were very few men of that sort about the country available; that is, really trained men whom you could take into the woods to advise you about the laws of woods and the suitability of the soil; and the evidence which has been before us is that there are not very many of these men about?—Because the pay does not allow them to be about, and they have no facilities for finishing off their education. The previous part of their education, the first three or four years, is very good, but there are many things which a forester, unless he has special facilities, cannot teach. He has not the time or ability. Therefore if the State were to take over these forests and put competent persons in charge, foresters would have opportunities of learning from them, and attending evening schools in connection with carrying out State forests.

3267. I gather that these men were not those who were trained in every branch of their profession; that they had not got as much knowledge as they should have had?—I think the majority of British foresters have not.

3268. So there is a great deal of need for more education?—Yes, that is one of the great points and one of the things I recommend.

3269. Now I would like to put to you one or two questions about the timber in Wales. We have had some evidence on that point. Is the timber on Lord Penrhyn's estate used for pit wood?—Yes, a great deal of it was sold in different ways; that is, so much per lineal yard or per cubic foot. In London it seems to be generally sold at so much per cubic foot.

3270. The small timber would go into stacks for the woods, what they call pit wood? It is not measured by the cubic foot; it is stacked up. There are so many cubic feet in the whole lot?—The poles of various sizes, sawn to three inches diameter at small end, were totted together and sold at so much per lineal yard.

3271. All the timber suitable for pits was sold at so much per lineal yard?—Yes.

3272. What was the price of larch there, for the best

Mr. A. D. Webster.

6 May 1902.

timber?—The prices of timber are not good in Wales; nothing like what they are here.

3273. About what was the price?—1s.

3274. (*Dr. Somerville.*) You have had considerable experience of forestry in the South-West of England?—Yes.

3275. You are acquainted with the copse woods in England?—With many of them.

3276. We may take it, I suppose, that copse woods are unprofitable nowadays?—Well, the prices are not as high as they were twenty years ago.

3277. Do you suggest that these copses should be converted into high forest, or be left till the times get better for that class of wood?—I do not think it will ever improve for that class.

3278. Do you recommend that steps be taken to convert them into high forest?—I do, and I have done a great deal towards that in the county of Kent.

3279. Do you plant your seedling trees after you have cleared off the copses? Is that the way you proceed to make the conversion?—A better way is by planting previous to clearing the wood, so as to give shelter to the woods which you plant. Another way is to thin out some of the trees, and leave the best oaks on the stump, and plant up through the woodland with your standard crop, then cut away the stools as your other timber is coming on.

3280. Do you find that land which has proved suitable for copses is also suitable for larch, and Scotch fir, and spruce wood?—Not for spruce, but for larch I should say; it would be too dry for spruce.

3281. (*Chairman.*) Will you put in your scheme of education, Mr. Webster?—I have not it here with me.

3282. Could you let us have it?—Yes.

3283. If you will do that we will look into it. Is there anything else which you want to put in?—There is nothing if you are not going to deal with the bog lands of Ireland.

3284. (*Dr. Schlich.*) When you give us that account of expenses in connection with planting in Wales at those high elevations, would you be good enough to put the expenses under the different heads? Taking a certain plantation, would you give the area, whatever it may be, and then say so much for the preparation of the soil, so much for the cost of plants, so much for putting them in, so much for fencing, and so on? That would be very instructive for us?—Yes, I can give that. But in the case of Lord Penrhyn's plantations they were not made for profit, and we formed them in the same way as if the Government were to do it.

3285. If you say how much you spent per acre, that would give us an idea of the cost?—Yes.

3286. (*Professor Campbell.*) Perhaps you will also put in a paper on the bogs of Ireland, and your experiences in Ireland?—Yes.

3287. (*Dr. Schlich.*) Have you any experience of planting on bog land?—A large experience.

3288. In what part of Ireland?—On the shores of Lough Neagh, and a full account is given in the Highland and Agricultural Society's Transactions.

3289. Where is that?—In the county of Armagh, on the banks of the Blackwater.

3290. Were they large estates?—They were not large plantations; but as they were formed 32 years ago, I examined them lately, and reported upon them, and I was surprised at the great improvement of the land. Formerly this bog was only of value for snipe shooting, and for cutting turf for fuel, and there were quagmires as large as this room. I was surprised to find how dry the soil was, and how well the trees had succeeded.

3291. Have you examined the depth of that bog land?—16 feet I have seen it dug to. But it varies much.

3292. Did you plant on that? If so, what?—Yes; there was a general mixture, larch, Corsican pine, Austrian pine, Douglas fir, and so on. I am sorry I have not my notes with me, for I could have told you exactly.

3293. It was originally pure peat bog?—Yes, bog from which they cut turf for fuel.

3294. Was it drained?—Yes.

3295. At what depth?—The main drains were, as far as I could say, about 6 feet in depth. The minor drains were less.

3296. What does the bog cost to drain?—I can give you the whole cost of it. It is all in the Transactions of the Society I have mentioned.

3297. You have examined it, and found 16 feet of bog?—Yes, 16 feet depth. I have seen through many of the bog lands 16 feet depth of bog cut.

3298. Was it drained immediately before planting, or did it lie for a number of years after draining?—It was drained for two years, and it was soiled. The soiling consisted of a number of Irish mud cabins which had been pulled down, and the whole cost of formation was very little. Each pit got a spadeful or two of this as a start, but it is surprising to see how dry it is now. Some of the butts of the trees were being sold for 9s. each, and that is very good.

3299. What height do they reach in 32 years?—The average height would be 37 or 38 feet.

3300. Did the Corsicans do well there?—They did very well, but the Douglas pine and the larch did the best. The larch is fairly free from disease.

3301. Was the Weymouth planted there?—Yes, but they did not do so well.

3302. I was in County Galway some years ago for the Congested Districts Board, and they wanted to know what they could do with bog land. As there was nothing to go by—I did not know of this splendid example which you have mentioned—I decided to go to the North of Germany, where they had been making plantations on bog. There I found plantations on bog land, and that I could pick out all the places where the bog was more than 3 feet deep. Up to a metre, or say a yard, the success of the plantation was very good, but the moment we came to a place where the bog was a foot or two deeper than that there was a decided falling off. You could go over that plantation, several thousands of acres in extent, and pick out the places where the bog was more than a yard deep. Where the plantation was bad you had only to dig, and you would find the bog 4 feet or more deep. So I am surprised that you had that result with 16 feet of bog?—But you will find a great variation in the depth of the bog. The bogs of Ireland are not like those of Germany, evidently.

3303. I speak from memory, but I think the bog in Germany was from 1 to 10 feet thick. If you say bog in Ireland is of an uniform depth, that means the bottom must be at the same level, or form a uniform slope. I do not see how the result you mentioned could come about unless you put some soil there first?—But bog land cannot be formed unless there is a certain depth of water. You must have a quagmire.

3304. Perhaps we do not quite agree about what peat bog means. I have no further question to ask.

3305. (*Professor Campbell.*) Have you had experience of any other part of Ireland except at Lough Neagh?—No, except to see them.

3306. Was the soil in all cases very similar?—Yes, very much the same. If you or anyone saw these plantations on the shores of Lough Neagh you would agree with me, knowing the date at which they were planted, that they have been a very great success, and I think that to the poor Irish people the labour of forming extensive plantations would be a very great boon. I think the laying out and establishing of plantations would be one of the means of doing a great deal of good in Ireland. Repeatedly I have been asked by Irish landowners to sell timber to English merchants, but as a rule they do not care to do so, because it is not worth their while to purchase the small quantity that is offered. In some instances the merchant said that if I would give him a guarantee of a specified quantity for several years in succession he would go to the trouble to find out freights; but with the present small quantity it is hardly worth while. So if there were a greater quantity of planting in Ireland, I think it would open up an industry which would be a vast boon to the country. Twenty-five years after they were established these plantations would give employment to a large number of the inhabitants. The conversion of timber, the taking of it down to the ports, and its export to England would be great.

Mr. A. D. Webster.

6 May 1902.

3307. Have you lived in Ireland for many years?—Seventeen years.

3308. There is a great demand for land there?—I do not know where. There is more waste than cultivated land.

3309. But there is a great demand for land in Ireland, is there not?—I never knew it.

3310. You do not know it?—No. My experience is that there is a greater waste of land in the corners of fields in Ireland than there is in England and Scotland.

3311. Do not the Irish people want to increase their holdings?—They may, of course, but the places I suggest planting would be of small value as holdings.

3312. Bog land is chiefly what you have spoken of?—Yes, principally.

SIXTH DAY.

Wednesday, 7th May, 1902.

PRESENT:

Mr. MUNRO-FERGUSON, M.P. (*Chairman*).

Sir JOHN F. L. ROLLESTON, M.P.	Professor JOHN R. CAMPBELL, B.SC.
Mr. EDWARD STAFFORD HOWARD, C.B.	Mr. JOHN HERBERT LEWIS, M.P.
Professor W. SCHLICH, C.I.E., F.R.S.	Mr. GEORGE MARSHALL.
Colonel FREDERICK BAILEY.	Dr. WILLIAM SOMERVILLE.

Mr. REGINALD H. HOOKER, *Secretary*.

Mr. JOHN MICHIE, called; and Examined.

Mr. J. Michie.

7 May 1902.

3313. (*Chairman.*) You represent the Highland and Agricultural Society of Scotland?—Yes.

3314. Are there any particular points on which you wish to be examined?—Well, I thought of simply two heads, namely, the importance of the teaching of forestry in the country, and the acquisition of an experimental area for the teaching of the practical part of the subject.

3315. What are your views on forestry education; do you think there is need for it?—There is very great need for it. That has been my view for a very long time indeed. Seeing that we lag so far behind other countries, and in view of the fact that I have no doubt at all that a universal timber famine is imminent, there is a great need for it. Some people put it at greater dates ahead than others, but from having paid attention to the general trend of things I do not think it can be delayed beyond some 30 years. Therefore I think it is beyond doubt a pressing question that the question of education in forestry should be tackled as soon as possible, that it should be tackled from the scientific point of view as well as the practical, but especially the practical, in this country, and that the two should go hand in hand. That is, were an experimental area obtained, I think the seminary for scientific teaching should be situated upon it. Of course I am speaking of Scotland, in which my experience has been obtained. The seminary should be in a central part of Scotland, where a variety of soils could be obtained of different exposures and different altitudes for the growth of the various species which are capable of being grown from a sylvicultural point of view in this country.

3316. Your experience is confined to Scotland practically?—Practically, although I have visited other places. I have been to Germany.

3317. I believe you are the Forester at Balmoral?—I was Forester at Balmoral. I am now the King's Factor or Commissioner there.

3318. With control of the forests?—Yes.

3319. What area are the woods over which you have control?—About 6,000 acres.

3320. Have you experience of any other parts of the country?—Yes, in Perthshire, Banffshire, Inverness-shire, and other parts of the country. My experience pretty well embraces most of it except the extreme north.

3321. Have you yourself felt the need for a thorough technical and practical training in forestry?—I have all along, but more particularly in the days when I used to be going from place to place, because you never get the same information twice. Where an experienced forester in those days, some 30 to 35 years ago, would have told you to thin a great deal, the next one would have told you that you were overdoing it, and they all had their various ways of planting, so that it was a kind of enigma that a youth was landed in in getting his knowledge of forestry in this country.

3322. Do you find an absence of record?—Yes.

3323. Of continuous management?—Yes.

3324. And that still exists?—Yes.

3325. Do you think there is a general desire amongst the working and head foresters for a regular forestry training such as that with which you became acquainted in Germany?—Unquestionably. Some of them have modified ideas about it. Some of them think (and possibly there is a good deal in it) that the German method as established there might not be in every detail adapted to this country, but my opinion is that you cannot go half way in the matter. You must adopt a system which is known, and the modifications will come later by experience.

3326. And of the classes which are connected with forest management in Scotland, which do you think it is most necessary to educate, the owner, the factor, or the forester?—By all means the three; but very specially the forester, the man who has the practical management.

3327. Do you think that in Scotland the head forester has sufficient weight to make his influence felt in the estate management so as to guarantee proper timber culture?—I am afraid not under existing conditions; but I think it ought to be so. If you educate the proprietor and his factor to a certain extent, you will get them to agree with the forester in his movements probably. Therefore I think it is very advisable that the three should have a knowledge of forestry—all concerned.

3328. Your view is that there should be an experimental area with a school upon it?—Yes, that is my opinion.

3329. Have you any ideas of any other form of forestry education, such as in connection with the University classes or in the schools?—There are so many sciences bearing upon forestry; in fact, from what we have been hearing in recent days, one would expect to find a British forester a sort of walking encyclopædia of knowledge. That is to say, he must know about chemistry, he must know about agriculture, all sorts of trainings, geology, and a great many of the sciences. In connection with the advancement we are making, which I hope will go on, County Council Committees and Evening Continuation Schools, all ordinary elementary schools throughout the country, produce an education which

Mr. J. Michie.

7 May 1902.

would be sufficient, in my opinion. If it goes on advancing as it has done, the young man or the boy in his earlier teens will receive a smattering of information at these classes which would be a great advantage to him afterwards, and would put him in a position, before entering upon his curriculum of scientific and practical training, at a site where you had a large experimental area (and it should not be less than 10,000 acres, with the seminary for actual scientific forestry education upon it), of obtaining a great deal of useful knowledge. I am putting the matter perhaps lower than some other people will. They say that this young lad should go to the forest centres of scientific training; but that cannot be expected from the fact that in this country, on the ordinary run of estates, he never can expect to get more than £100 a year, and very frequently much less, according to the existing state of things. Even in future days it is difficult to see how a forester pure and simple can be very highly paid—to be so highly paid as to warrant his going through a lengthened and minute and varied curriculum.

3330. Then you would attach importance to the forestry training of factors?—Yes, I would. But here you are met again with the difficulty that you cannot make him a practical man.

3331. Would the training of owners and factors have an indirect effect by raising the remuneration of foresters?—I should think there was little doubt about that. It is, however, on its merits I speak of that—namely, that ordinary-sized estates I do not think will admit of large salaries being paid.

3332. Then you would call in, perhaps, one expert to control a certain number of woodlands belonging to different estates?—Yes, that would be a very good idea indeed.

3333. In the same way that Mr. Grant Thomson manages various woods?—Yes; in the same way that I have been called upon to do it myself in various parts of the country.

3334. You think that an area of 10,000 acres should be set apart, partly, I suppose, under timber, and partly to be planted as a State Model Forest School?—Yes. It is a matter, however, that would require to be gone carefully into in my view. It would require when purchased to have a certain amount of old timber of as varied a kind as possible.

3335. Do you think it would be possible to buy that land if it was done judiciously, at a rate which would not involve any very heavy loss?—I do not see why it should in the end; but gains would necessarily have to be deferred. It ought, in time, to be a paying speculation. You know as well as I do that it takes a hundred years to rear a forest.

3336. Meanwhile, if it was in a moorland district you would get a grouse rent for a considerable portion of it?—No doubt you would get a grouse rent in Scotland. So long as it was moor and grouse.

3337. And so long as a portion of it was bare you would derive other revenue than merely the timber revenue?—That is so. You would get other revenues. If it was under agriculture you would get your agricultural revenue.

3338. Either from game, or from agriculture, or from grazing you would get some return in addition to the return from the woods?—Yes.

3339. Taking it altogether, do you think it would be possible to buy such an area and to obtain some interest on the money expended?—Oh, yes; I have no doubt about that. It might take some time to get a place suitable in all respects; it depends upon the disposition of the proprietor of a suitable place to sell.

3340. What do you think a good centre?—I do not think Perthshire could be beaten, where you have low ground, medium hill ground, and even high glen ground. I think the three varieties ought to be there.

3341. And on that area would you find employment for working foresters, and would you give instruction for all classes of those connected with land, or only for the working foresters?—I should give instruction there and nowhere else to all three, so that they might be brought together in the science and practice. The science of forestry is so mixed up with the practice of it in this country, and everywhere else, so far as my knowledge goes, that it is impossible to separate them in the teaching.

3342. Your scheme would involve a heavy expenditure?—But a desperate disease needs a desperate cure.

3343. You do not think that the scientific instruction can be so profitably given at the University of Edinburgh as in the forest school in Perthshire?—I would not like to employ a man who had his training in the University of Edinburgh to go and overlook the practical work of an estate.

3344. You would not trust the owners and factors who had had their training there?—No.

3345. You would prefer it in the forest school?—I should.

3346. (*Professor Campbell.*) In talking of the proposed central experimental area, you said that it would be necessary to have all soils, altitudes, and aspects. Do you think these can be obtained at one centre?—Perhaps that was rather strong, but I do think that the forest school and the experimental ground ought to be at one place. Excursions might be made to others at certain seasons of the year. You cannot get everything in one spot on the surface of the globe, but you can get a place more suited to it than the majority of other places; that is to say, you can get a place with a variety of soils, with a variety of altitudes, and a variety of exposures.

3347. So that if you could not get it all in one, you would be in favour of having different centres, but I take it that your main working forest would be principally where the teaching would be given?—Yes, the principal one, and the only one so far as the actual teaching and experimenting is concerned, but other parts of the country might be visited.

3348. I understand that you have yourself studied some of the sciences to a small extent?—Yes.

3349. Which of them do you think would be of most service to you in your work? I think you mentioned chemistry?—I am afraid I have not studied much chemistry in my time. Geology is certainly an important subject.

3350. Are you prepared to offer an opinion as to the absolute necessity of foresters having studied these subjects? — Not to any great extent, but roughly. If he knows the effect of limestone, if he knows what he is to expect upon granite, and what he is to expect from the Silurian formation and the soils resulting from them, it would be sufficient.

3351. So that the science training a boy gets in a good grammar or secondary school would be quite sufficient?—Yes, in the secondary school I think it would.

3352. You would then put him direct into the forest?—Yes.

3353. Would there be any need for any further scientific education?—No, there would be no need for university education and no remuneration for it when you got it.

3354. You mentioned that a timber famine was imminent. Have you looked into that question yourself, or are you merely giving an opinion formed on what you have read?—I am giving an opinion of what I have read, and from coming in contact with those who have travelled more or less in the various countries from which our timber supplies come.

3355. (*Dr. Schlich.*) I wish to ask you some questions about the timber famine to which Professor Campbell has referred. You have arrived at the conclusion that a timber famine may be expected in about thirty years?—Yes.

3356. I should be much obliged if you would tell us on what grounds you fix upon that number of years?—I may give you one as an example. Thirty years ago and even less, everybody who pretended to know anything about timber, such as wood merchants and people who came from the actual ground, would have told you that the American forests were inexhaustible. Even then I was not of that opinion, because everything has an end, and, as a matter of fact, nowadays the Americans require most of their timber themselves. They are importing to a considerable extent from Canada, and we have the greatest difficulty in this country in getting yellow pine, which used to be sold at about 1s. a foot; 5s. a foot is being paid for it nowadays. That is one example that I went upon in fixing that number of years. All are agreed that the timber supply of the Scandinavian peninsula is fast being exploited, and authorities in that quarter agree that we shall have little chance of getting much from there by that time, of the old quality of stuff at least, and the young will barely be ready.

Mr. J. Michie.

7 May 1902.

3357. I asked you that particular question because a French authority has said that the timber famine would be upon us in 50 years. I had an opportunity of writing on the same subject, and I said that according to my idea it would come before 50 years, so that you agree with me that it is likely to come before the end of 50 years?—I do unquestionably.

3358. Speaking of the education of the proprietor, the factor, and the forester, you said, especially with regard to the education of the factor, that you could not make him a practical man, that you did not wish to make him a practical man, but do not you think it is of the utmost importance (considering that at present the forester very often does not carry the necessary weight, as you have pointed out to us) that the factor or agent should be educated sufficiently with regard to forestry questions, so as to understand and appreciate what may be placed before him by the forester?—Unquestionably.

3359. And do you not think that the same applies, and perhaps even with greater force, to the proprietor? Of course you do not want to make the proprietor or the agent go and swing the axe or plant the tree, but do you not consider it of the utmost importance that both the proprietor and the factor should have sufficient knowledge of the forestry business to appreciate its importance, and should understand what is put before them by a practical forester?—I do, and hence my opinion that he should be educated on the actual ground upon which the forester is educated.

3360. So that you agree with me on the main point, but you want the proprietor, agent, and the forester all educated at the same place?—Yes.

3361. Do not you think there would be difficulties in the way of that? Do you think you would get many proprietors to go to that particular place? The proprietor of a landed estate, just as likely as not, will go to a University, and do you not think that he would be much more likely to acquire a certain knowledge, if he has an opportunity of doing so, while he is at a University, rather than if he went and spent I don't know how many months, whatever the time may be, at a special establishment where the forester is educated?—I am afraid if it is necessary for him to have the information that he will require to be at the other place in order to see men doing the thing. Forestry is so much a matter of practice that unless you see something of the actual practice the education is not of much advantage. The science of the question, so far as I am aware, judging from my experience of those who have turned up saying that they knew something of the science of forestry, does not count for much without the practical knowledge. When you come to take such men over the actual ground and show them what it is, you find they know nothing in the world about it. There are exceptions, no doubt, but always giving a certain amount of law for common sense, it is such a rare sense, somehow or other, that when you get the scientific man, you find that he knows very little about the subject. The forester may perhaps come afterwards and say that a certain thing was properly done, and the scientific man would say that it was not, and that he did not need the forester's services. All the while, however, it is quite possible to imagine that the forester is doing his work well. I think that the landed proprietor should go to this seminary and take his walk in the forenoon or in the afternoon, as the case may be, and see the work being done, and take the scientific part of his education in the matter at another part of the day. There may be difficulties in the way; no doubt there are, but it seems fruitless for the prospective landowner to spend his time at the University in being educated in some things; but if he, as he ought to do, attaches sufficient importance to his paternal estate, he ought to go for a year, or at least for certain portions of the year, where he would obtain the best possible information on the science and the practice of that important department in connection with his property.

3362. You say "science and practice"; but who is going to teach him the science at a particular school where you would educate the foresters?—He must be taught by a teacher who knows, simply just as he is taught other things.

3363. Do you not think you would have to keep quite a number of teachers at that place if you were going to carry through that scheme for all three?—There would need to be teachers for the various branches, no doubt.

3364. You must be aware that the results of investigation and of practical experience have been brought together in such a way that a proprietor or a man who tries to train himself as a factor could in a short time, while, say, at a University, or whatever the educational establishment may be, get a general view of what is known about the treatment and management of forests, and if he afterwards, on the top of that, goes actually into forests here and there and compares what has been put before him in the lecture-room with the actual state of affairs on the ground, do not you think he would be much more likely to get a more general view of the business than if he goes to one particular point and studies in the same place, where all the details and the minute working of the forest are gone through?—That would be possible, but I still adhere to my opinion with regard to the matter. The other would be the near way to it.

3365. (*Colonel Bailey.*) You said just now that you found men who have been through courses in this country have not a good practical knowledge?—Yes.

3366. You are aware, of course, that there are no facilities for giving them practical knowledge—that we have no forests in Scotland at the present time that have been managed correctly for a sufficiently long time to make them available as fitting fields of practical instruction—that is so, is it not?—Yes, I suppose so. I am aware of only two places in Scotland where the science of forestry is professed, yours and that of Professor Balfour's; both are well conducted, but there are no facilities for practice.

3367. Take my own course at the University. You know, I suppose, that I have no field of practical instruction available?—That is so.

3368. But do not you think that if a field of practical instruction could be provided that might put a very different complexion on the matter?—No doubt it would be in the right direction.

3369. If a proper field of practical instruction could be added and made available for the University, the men turned out might be of a very different quality to what they are now?—No doubt they would be improved.

3370. If you undertake to teach a man in any special subject like surgery or medicine or engineering, you do not expect that man when he has just left college to be a complete master of the practice of his science, do you?—No.

3371. He has had a preliminary training at a school or college, then he goes out into the world equipped with that training in order that he may learn how to apply it?—That is so, but still the medical hall and the infirmary are not very far separated.

3372. You would not expect a young doctor turned out after his course of five years at the University to be a complete master of the practice of surgery or medicine?—Certainly not.

3373. Similarly, after a forestry student has left the University where he has followed courses of various kinds, and has had practical instruction on the State areas that may be provided, but have not yet been provided for him, you would not expect to find him a complete master of the practice of forestry, would you?—No.

3374. But you think he would have had a training that would enable him to become a practical man in a relatively short time?—Yes.

3375. He has what will enable him to become a practical man in the future?—Yes.

3376. Hence, if you get a student who was at first rather at sea in practice, you would not necessarily think that that condemned him?—Certainly not; that is, in the proper direction. But I think there ought to be an out-and-out move in this question. Those are the lines which I believe are the important lines, namely, that you must have a great deal of practical teaching, and the scientific teaching going hand in hand with it.

3377. I am absolutely at one with you in regard to that. There is only one other point. You said a little while ago that the low rate of pay which is now given to foresters renders it very difficult for them to obtain a high-class training; do you think that if proprietors realised the great value that their woods might have if properly managed, this might have some effect in raising the remuneration of foresters?—Yes, I do think so.

Mr. J. Michie.

7 May 1902.

3378. It would raise the remuneration that it would be worth while for the proprietor to pay his manager?—Yes, I think so; but there are so many small estates.

3379. But still it would have that effect, taking it generally over the country, would it not?—Yes.

3380. Do you think that a State model area, in which all work would be done in the best possible way with a view to profit, which would be open to inspection by proprietors and others interested in forestry, and where accurate accounts of all expenditure and receipts were kept, would be likely to have any effect upon the proprietors in informing them as to the value of their woods?—Unquestionably.

3381. Therefore the provision by the State of a model forest, to be used for instructional purposes as well as to serve as an object lesson for proprietors and others, might have a very important effect both in training foresters and in raising their position?—Yes.

3382. (*Sir John Rolleston.*) I think you say that there are certain consulting foresters in Scotland?—There are a few. With all deference, it is only the intelligent proprietors who have availed themselves of their services here and there, just where they could be obtained and depended upon; but I think, after all, that they are the men who have obtained their information by the sweat of their brow, so to speak. They have gone into the thing on their own initiative, and made themselves masters, so far as they could, of their profession.

3383. There are none in England, I am sorry to say, that I know of. The wages of a forester on a small estate of course must be smaller?—Yes.

3384. But there is no reason why the emoluments of the consulting forester should not be very large?—That is so; they might be very good indeed.

3385. And if a class for consulting foresters of that sort were encouraged at the Universities it would be a very useful thing, would it not—men who would not take sole charge, but who would go and advise for fees?—Yes; no doubt such men could always be found, if the experimental area were first obtained and the seminary situated upon it. You would always find that the best man from such a place would be the one who had equipped himself in after years by extensive experience.

3386. (*Mr. Marshall.*) You stated that you thought Perthshire would be a very good place for a State experimental forest?—Yes.

3387. I suppose you would want, for the scheme to be successful, a certain amount of high land and a good deal of low land?—Yes.

3388. Would it not be a very expensive business to acquire a place of that sort in Perthshire?—I have no doubt it would be an expensive business.

3389. Most of the low land would have fishing on it—of course that would not interfere except to make it very high priced—and shooting rents are very high in Perthshire too, are they not?—Yes, they are.

3390. Have you any idea at all what an estate of 10,000 acres in Perthshire suitable for a State forest would cost?—It is very difficult to say, because I have not any particular spot in view. Offhand, I should say that a third of it should be good fair agricultural land, which would cost £1 an acre. I do not think 25 years' purchase for that would be too much. Roughly speaking, that would be about 3,000 acres. Then you would want 3,000 acres of medium ground, such as is generally planted in the semi-highlands at the present time, and the remaining 4,000 acres of higher ground. The medium ground I should put at, say, 10s. an acre, and the higher ground at 2s. an acre.

3391. Four thousand acres at 2s., 3,000 at 10s., and 3,000 acres at £1; you think it would be possible to buy a suitable area for that price on the basis of a 25 years' purchase?—Yes, but added to that you would require to put on the shooting rent.

3392. That would be another considerable item?—Yes, that would be something. For grouse rent over the 4,000 acres I should put at something like £750 a year if it were in a very grousy place. Then there is the valuation of the woods.

3393. That would make the whole thing rather expensive?—It would.

3394. Let me ask you one or two questions about the Royal woods at Balmoral. Have you done much in the way of forestry there, or have they been left alone?—We have done something within the last 10 years on the thick planting system, and the management for a considerable time has been considered by those who have seen it to be good. We have a considerable area of natural forest there which has been very little touched. It has been open to deer, and in consequence does not regenerate itself. Where there are large herds of deer and sheep it is well known that it is no use to attempt natural regeneration in such places.

3395. Do you think His Majesty takes much interest in forestry?—I am sure he does.

3396. (*Dr. Somerville.*) Speaking of this forest area that you suggest the State should acquire, you spoke of land of the value of £1, and also land of the value of 10s., an acre. I suppose that would be agricultural and pastoral land?—Yes.

3397. Would you suggest the planting of land which could be let for agricultural purposes for £1 an acre?—There are so many points to be considered. There is always the question of the quality of the land, such as good strong clay land or a mixture of clay and alluvial matter, and so on. It sometimes happens that even with land at £1 an acre a sufficient return may be obtained to warrant its being planted.

3398. Do you think that the profits of forestry in this country sometimes amount to a net return of £1 an acre?—Yes.

3399. I suppose you would have no scruples about thinking that land at 10s. an acre might often be planted with very considerable profit?—None.

3400. You have had experience, of course, of forestry at considerable elevations in Scotland: do you find trees in your district grow well up to an altitude of 1,000 feet?—They do.

3401. How high do you consider it to be profitable to plant trees in the highlands of Scotland?—It depends upon the height of the neighbouring ranges, but near the higher ridges of the Grampians they certainly grow profitably up to 1,500 feet.

3402. What trees would you consider to be most suitable for planting at these high elevations?—The native Scotch pine.

3403. You find that the native pine grows better at a high elevation than larch?—I do in the particular sites I am thinking of now; but, given a loose Silurian formation or any formation suitable to the larch, I do not say it does.

3404. Have you had considerable experience of so-called German larch as well as native larch?—Yes.

3405. Could you give the Committee any opinion as to the relative merits of German or Tyrolese and the larch grown from Scotch seed?—The result of my experience in that direction is most decidedly in favour of the Tyrolese larch.

3406. In what way do you find it surpasses the larch grown from native seed?—It is more vigorous, and less susceptible to disease.

3407. Have you ascertained that from your own experience?—I have.

3408. Can you illustrate your answer by giving us a specific example?—Yes; it is to be found on the Balmoral property.

3409. Where you have the two larches growing on practically the same kind of soil, and with the same exposure, the larch obtained from Tyrolese seed shows advantages?—Yes.

3410. I believe you are aware that many nurserymen talk in terms almost of reproach of Tyrolese larch?—That is so.

3411. You are then opposed to the prevailing view amongst nurserymen?—I am. I will give you one example, if you care to listen to me, with regard to that. I was taken once by a nurseryman who was altogether opposed to what he called my theory, and he showed me two beds of larch side by side, one from home seed and the other from Tyrolese seed. To start with, something like 95 per cent. of the Tyrolese seed had germinated, whereas but 50 per cent. of the home seed had germinated. He pointed to the apparent good health of the home plants as compared with the Tyrolese, which I admitted. That, however, was in the month of June. Early in the month of May there had been severe night frosts. The Tyrolese larch from its vitality had responded to the first impulses of spring

Mr. J. Michie.

7 May 1902.

by sending forth its tender leaves; whereas the bark-bound nature of the acclimatised plant had stood still and refused to risk out, to be exposed to the late frosts. The consequence was that the Tyrolese plant was hanging its head from being nipped by the frost, but its bark was straw coloured, light and clean, and beginning to come away again, as compared with the stiff and stunted and less vigorous—less vigorous because less active—home plant. Then the same thing occurs in autumn. The Tyrolese larch grows on with vigour into the frosty season of the autumn, and gets its point nipped again; whereas the less vigorous home plant has got over its growing, and hardened off all right. But as time goes on, when the two plants are put out in the forest, the Tyrolese plant quickly gets over its reversals of fortune and moulds itself to shortened growth as it gets older; whereas the home plant, as a rule, becomes the subject of disease and blister, and dies off before it is half old. That is a summary in a few words of my experience, and a comparison of the two plants.

3412. Have you tried the Japanese larch at all in your district?—Yes.

3413. What is your experience of it so far?—It is hardy, about as hardy as the home larch, perhaps rather more so, I think, as regards spring and autumn frosts. I have seen no disease upon it yet, but the oldest plants I have are only about sixteen years of age, so that I cannot say very much about it.

3414. But sixteen years is quite a sufficient time to test its immunity or otherwise from disease? Have you found disease upon the Japanese larch at all?—Not at all.

3415. So that up to 16 years of age, in your experience, it is absolutely free from disease?—Yes, but my experience is not very extensive as regards Japanese larch.

3416. But still you have had a considerable number of plants under observation?—Yes; but it may become more susceptible to disease after a time. I hardly think it likely that we should have found disease in the Tyrolese larch so soon after its introduction.

3417. In other words, you think that the Japanese larch at the present time is occupying a position which may be compared to the position occupied by the common larch about the beginning of last century?—That is so in some respects, but not in all. I do not think it will ever be of the same importance, from its slowness of growth. It is certainly slower in growth than the native and Tyrolese larch after it is put out.

3418. Do you find that it starts more rapidly in youth?—Yes; it starts very rapidly in youth; it goes on equal to the European larch, but later on it seems to get more stubby, and to be of much slower growth altogether.

3419. Do you extend your opinion with regard to the relative merits of Continental and native larch to Continental and native Scotch fir?—By no means. I would rather put it the other way, in favour of the home article.

3420. Do you find that the seed obtained from the Scotch pine of your district produces better plants than the seed obtained from Germany?—I think so.

3421. A great deal of the land which, I suppose, you would recommend for putting under forestry in Scotland is at present under sheep, is it not?—It is.

3422. Is sheep farming in the Highlands of Scotland a very remunerative industry?—By no means at the present time, not nearly so much as it was in previous years—back in the 70's, 80's, and even the 90's.

3423. I suppose then that the condition is reflected in the rent of the land?—It is.

3424. Then rents have come down very much, I suppose?—Yes, and they are coming down still.

3425. Do you know what the rents of sheep farms in the Highlands run to per sheep?—I am not prepared to say that off-hand in a general way, but I think you may take it from 2s. to 5s. a head.

3426. How many acres of Highland sheep land does it take to carry a sheep during the year?—From one to two.

3427. Is there much land in the Highlands which can be stocked at the rate of one sheep per acre, or even one sheep per two acres?—I am taking land suitable for forestry; I do not take in the hill tops. Suitable sheep pasture land ought to carry that quantity, but not during the winter. Winter is the big thing.

3428. I am referring to keeping the sheep through the whole year?—The great majority of hill pastures cannot keep them in the winter time at all; they have to be sent away to winter.

3429. What number of men do you think 100 acres of land under various ages of trees would support?—That is rather a knotty question, and one to which I am not exactly prepared to give an answer. It would vary according to the quality of the land and the position. There is such a wide range in giving an answer of that sort.

3430. Very well, I will not press you upon it, but we were rather anxious to get information from men of local experience, such as yourself, with regard to the influence of the extension of forestry upon the population. Suppose a man had 1,000 acres under forests on an estate, how many labourers and foresters do you think that 1,000 acres would employ consecutively during the year?—Merely for the growing and exploiting of timber, independent of manufacture, it would easily employ ten.

3431. That is one man to 100 acres?—Yes.

3432. How many sheep would a 1,000 acres of ordinary hill land keep?—I am going to give you an answer in a general way, covering the whole thing on the basis upon which you seem to put your question, taking in the hill tops and everything else—about 500.

3433. Will 500 sheep give employment to a shepherd?—Yes.

3434. It comes to this then, that a thousand acres of ordinary Highland land would find employment for a man?—Yes.

3435. Whereas a thousand acres under trees would find employment for ten men?—Something like that. I think that would be a fair proportion.

3436. And that is altogether apart from the working up of the forest produce in the neighbourhood; your figure only refers to planting, thinning, and felling, and possibly does not include the dragging of the timber out of the wood, its removal to the saw mills, and still less does it include the labour that is required in the saw-mills themselves?—That is so.

3437. We may safely say, I suppose, that forestry would give employment for at least ten times the population that is provided for under a system of pastoral farming?—That would be a fair estimate, I think.

3438. What sort of quality do you find that the Scotch pine of the Highlands attains to?—Just as good as ever came from the Baltic.

3439. Do you consider, in fact, that the Scotch pine of the Highlands, grown under suitable conditions, is quite as good as the red pine of Sweden and Russia?—I do.

3440. Do you use much of your home-grown stuff in the erection of buildings on Deeside?—Yes, almost exclusively for some time back.

3441. I suppose you have not had that timber in the buildings long enough to see how it is going to last?—I know of some timber in some buildings at Montrose which is 300 years of age.

3442. So that you do not consider there is anything in the charge which is sometimes made that we cannot in Scotland grow as good pine timber as can be grown abroad?—I do not.

3443. And if the timber is bad, knotty, is open in the grain, and soft and spongy, that is a question of management, and not a question of soil and climate?—That is so, so long as you stick to the mountain ranges, and do not go down into the low-lying plains of clay, and so on.

3444. I suppose these low-lying plains are, for the most part, under agricultural operations, and are not really forest land at all?—That is so.

3445. (*Colonel Bailey.*) Were you at the Forestry exhibition at Inverness?—Yes.

3446. Did you see the timber which Sir Robert Menzies sent from Menzies Castle?—Yes.

Mr. J. Michie.

7 May 1902.

3447. Do you know that he says he has beautiful Scots fir timber which has been in the Castle for 300 or 350 years?—I believe that is so, although I had not that fact in my mind when replying to Dr. Somerville's question, but I thoroughly believe it.

3448. Now I wish to ask you a question about the Japanese larch. You say that the Japanese larch is free from disease up to about sixteen years of age, but that it has rather a stunted habit?—Yes.

3449. Do you know which species you have got in your forest—are they all of the same kind?—The only species I know of is called the *Larix leptolepis*.

3450. Do you think that you always get the *Larix leptolepis*?—I believe all I have is *Larix leptolepis*. I do not know that I have any other kind of Japanese larch.

3451. In Japan there are, I believe, five different species of larch, and I have heard it said—with what truth I do not know—that these species have very different habits, and also have heard it said that you do not always get the kind of Japanese larch seed that you want. Sir Robert Menzies I know claims that he has had the seeds of two perfectly distinct species sent to him under one name, and that one of these species grows up straight and tall, and looks as if it would produce a fine timber tree, whereas the other has a low bushy habit, and will never make a timber tree. Have you ever seen anything of that sort?—I cannot say anything on the subject at all. I can only say with regard to the *Larix leptolepis* that it shoots up very strong when very young, and then after, perhaps, five or six years, it gradually begins to shorten its growth until it gets much more stunted at sixteen years of age. While on the question of foreign trees I may say that I have a strong opinion as to the quality of the *Abies Douglasii*, the Douglas fir. I think it is going to be a fine tree in the country.

3452. (*Sir John Rolleston.*) You said that the Scotch pine, if grown under proper conditions, would give as good timber as Baltic timber?—Yes.

3453. But grown in the south of England, say the New Forest, does it make good timber?—I would not say that it is not perfectly good in such a soil as there is in the New Forest. The bare soil of the New Forest I have no doubt would produce excellent Scotch pine timber, probably as good as we have in the north, always provided that you clear off the bad atmosphere, that is the atmosphere charged with carbon, and the various dirts which fly about in a thickly populated country.

3454. Then it is a good timber tree to plant even in the south of England?—Yes, the soil conditions being good and the management correct.

3455. May I ask you one question with regard to the interesting evidence you gave about larch. The original larch was the Tyrolese tree, was it not?—It was.

3456. Therefore the seed of this Tyrolese larch now grown will deteriorate?—I have no doubt about it.

3457. It ought to be perpetually replenished by Tyrolese seed?—Yes, just as we ought to go back to the natural habitats of the Scotch pine for the seeds of the future—Strathspey, Deeside, and other parts of the Highlands.

3453. (*Dr. Schlich.*) You said, I believe, that your Japanese larch was free from disease?—So far as I have seen it.

3459. Where that Japanese larch is grown, have you any ordinary larch in the vicinity in a similar situation?—Yes.

3460. Is that diseased?—Within 12ft. of one plant I noticed three diseased, blistered plants with the aphis upon them, too.

3461. But not upon the Japanese?—The Japanese are untouched.

3452. Your own private opinion is that in all probability bye and bye we shall have the same misfortune with the Japanese larch that we have now with the ordinary larch?—That follows.

3463. That is your personal opinion?—Yes, that it will probably happen.

3464. Perhaps it will interest you to know that the disease has been found on the Japanese larch certainly in two undoubted instances. At the same time it has been noticed that when the Japanese larch and common larch are together the disease generally attacks the common larch before it attempts to attack the Japanese?—It is interesting to know that.

3465. (*Chairman.*) You have given us some evidence about larch. Does not the frosting of larch in the nurseries often occur through the nursery being placed in too warm and sheltered a position, facing the sun?—Yes, in too frosty a position, and too level and flat. It frequently occurs that the site of the nursery is very badly chosen in that respect.

3466. It is chosen rather as a forcing ground than as the best site for the young trees?—Yes, very frequently.

3467. Do you think it desirable to have experimental stations in which experiments, for example, connected with larch disease, could be carried on, and tests made of the various mixtures with which larch may be grown in order to keep it more healthy?—Yes. I think it would be very interesting, and very valuable in fixing proper lines on which to grow the plant, and from where to get the seed.

3468. And that can only be done by the State or some public body in order to ensure the continuity of the experiments?—I should say that that was the case.

3469. Have you had any experience of natural regeneration?—Yes.

3470. Do you think it is sufficiently practised in Scotland?—No.

3471. In answer to Dr. Somerville you gave your opinion, generally speaking, as to the population which could be maintained in the Highlands by forestry as compared with sheep farming, and your estimate was based solely upon the growth of the timber: Are you of opinion that with a full crop upon the ground—which we very seldom find, it is true—with the sawing, milling, creosoting, local orders, building, a certain amount of carpentry work, utilising the hard wood by band saws, and so forth, that the same population if not, indeed, a larger one, could be maintained by manufacturing the wood than even by its growth?—I should think that would be so, that even a larger population could be maintained by the manufacture than by the growth.

3472. I have no figures of my own, but that is rather my experience?—Off hand I should say that more would be maintained by the conversion of the timber than by its growth.

3473. Knowing the Highlands well, and probably also what has been for some years known as the Highland land question, are you satisfied that the extension of forestry is perhaps the most effective means of solving any land question of the Highlands by giving this larger employment to labour?—I am very strong on that question: I think it would be the most effective means.

3474. And you think you would raise the status of the inhabitants of the poorer districts effectively by the extension of the wood-land system?—I think so, I have no doubt about it.

3475. Do you think there is a very large area in the Highlands which is available for profitable afforestation?—Yes.

3476. And that it is a purpose to which a great extent of the Highlands could be most profitably put?—Yes, certainly.

3477. Have you any idea of what sort of proportion of the heather land in Scotland could be properly afforested for the growth of timber?—I have not gone into that, but there certainly would be a very great proportion of it if you excluded the grouse and the deer idea. I have no doubt that something like three-quarters of it would be available for forests.

3478. Although grouse rents are high now-a-days, and deer rents in some cases bring in something also, you think that the returns from forestry would compare favourably with the sporting rentals if the woods were once properly managed?—Yes, of course, looking a great number of years ahead.

3479. There would be an immediate loss?—Yes, a very considerable loss for many years to come.

3480. Do you think it will be done largely by private owners or are you of opinion that if it is to be done you would have to look to the State for support?—Private owners have already scouted the idea for these very reasons, and we should certainly have to look to the State in the matter.

3481. Then you would look to a large proportion of the Highlands being covered by State forests?—I suppose that would be natural.

3482. (*Dr. Schlich.*) Do you think that if the lower parts, or a considerable proportion of the lower parts of the deer forests in the Highlands were under forests,

Mr. J. Michie.

7 May 1902.

that this would in any way interfere with the shooting rents?—I am afraid it would.

3483. Why?—Because it interferes with the stalking so much.

3484. Is the stalking done very much in the lower parts?—The stalking is the great thing in deer shooting in this country.

3485. Stalking would be interfered with even in the lower parts—I am not speaking of the higher parts?—It depends upon the proportion. The belts of wood in the lower parts would not be affected—as a rule we already have belts in the lower parts, but not in all cases—but generally speaking, where there are deer forests there are some patches of wood on the lower ground.

3486. Do you think the very extended planting up of the lower parts would interfere with the rents?—Yes; to plant up even the lower parts of the deer forests to any great extent, say one-third or one-half of the total area, would interfere I have no doubt with the rents. In the first instance it would, from the deer having to be kept out of the area altogether.

3487. Not for ever?—No; but altogether for the first ten or twenty years.

3488. (*Chairman.*) Probably the loss involved in the deer rents would be best mitigated by planting by degrees, and opening up the woods as soon as they came to a height where the deer could do them no harm?—Yes, that is so.

3489. And in that way eventually I suppose a considerable portion of the lower parts of the forest might be planted without loss of rents?—Yes, that is the case, but not to any great extent.

3490. If it were done sufficiently slowly?—Yes. As you put it, the loss would be mitigated by that, but the rent certainly would not be so good, because stalking is the great thing. I have frequently heard sportsmen and, what is almost of more importance, the gamekeepers or deer foresters, go dead against large planting.

3491. You are aware that some woods at Beaufort are let for a considerable sum for deer shooting, but at the same time we all know great rents are given for the bare hill?—Yes, for the open hill where they can stalk.

Professor H. Marshall Ward, D.SC., F.R.S., called; and Examined.

Professor H. M. Ward, D.SC., F.R.S.

3492. (*Chairman.*) I believe you are a Fellow of Sidney Sussex College, Honorary Fellow of Christ's College, and Professor of Botany in the University of Cambridge?—Yes.

3493. And you have been nominated by the University of Cambridge to give evidence here?—Yes.

3494. Can you give the Committee your opinion as to the suitability of Cambridge as a centre for forestry instruction?—It seems to me the want of forests in any extensive sense would be felt in any teaching of forestry pure and simple, but in other respects it would appear that for the instruction in subjects on which forestry depends, Cambridge might be an admirable centre. There is already a course of instruction in the sciences on which agriculture is based, and I think we may say it is a successful course, and many subjects that would be necessary for forestry would be the same as those that are necessary for agriculture, so that for a large proportion of the subjects, the sciences on which forestry is based, I should say that Cambridge is admirably suited as a centre for instruction.

3495. I think your view is, that with the appointment of a lecturer on forestry at Cambridge the theoretical teaching would be complete there?—The theoretical teaching may be said to be complete, or could very easily be rendered so.

3496. Is it your view that students at Cambridge could best obtain their practical instruction on forests on the Continent, or by endeavouring to establish a forest garden or a forest area in the neighbourhood of Cambridge?—It has often appeared to me that a forestry school could grow up with a forestry nursery or a forestry garden, and it seems a pity to go abroad, since there could easily be established within reasonable distance of Cambridge young forests in a short time. If the question of going abroad is raised, why should we go to the Continent? I think that in Scotland, for instance, and in many other parts of England, it would be possible to find a forest that would answer for the purposes of illustration.

3497. You would probably consider that some of the forests on the Continent are better grown than the forests in this country?—Undoubtedly. Forestry in Germany and in France has been practised for so long a time on well-known lines that the art is there as near perfection as it can be.

3498. Would it be possible to establish a model forest or a sufficient forest garden in the neighbourhood of Cambridge?—I have my doubts about the immediate neighbourhood of Cambridge. Cambridge is one of the driest counties in England, and it would need experts in forestry (I am not an expert in the practice of forestry) to decide that question. I believe doubt has been expressed as to whether forests could be readily grown on a large scale near Cambridge.

3499. Is there any land in the neighbourhood belonging to any of the colleges or to the University which could be acquired for that purpose, say within 10 or 15 miles?—I am not accurately informed on the subject, but my impression is not to the effect that it could.

3500. But you think that with a forest garden in the neighbourhood of Cambridge, such as they have at Giessen in Germany, you would have sufficient practical demonstration in order to make the forestry course there a success?—Not if what is wanted is a complete forestry course, but for the teaching of the principles of what we call forest science it ought to be possible to make it quite a success.

3501. In conjunction either with tours abroad, or through the woods at home, the course would be complete?—Yes, there is no reason why it should not be made complete.

3502. And if you did not find sufficient provision in the woods at home it is practically easy to get abroad from Cambridge?—Oh yes, there is no difficulty in getting abroad from Cambridge.

3503. For the encouragement of forestry we have had a good deal of evidence that it would be advisable that the landowners of the country, the younger landowners, and those who are likely to become such, should receive forestry instruction. Would not either Cambridge or Oxford be very suitable as a centre for directing the attention of those connected with land to the science and the practice of forestry?—Yes.

3504. Probably landowners and land agents would find Cambridge and Oxford the best centres at which to study?—Yes, and if I may express my opinion I should go further than that. There are many young men who come to Cambridge who are studying sciences of the kind we are considering, who have no very definite views as to what their future life will be; I believe if it was understood that there was such a career as that of a forester or a land agent in the sense of a forester, many of them would be interested in it, and probably some would take it up as a definite profession.

3505. Would it be possible to work in the theoretical instruction at Cambridge with a State model forest situated in a locality more favourable for the growth of trees, at no considerable distance from Cambridge?—I think so, though it has always appeared to me that there are some advantages (I do not say there are no disadvantages) in separating the theoretical part of the training of a forester from the technical pursuit of his art afterwards. May I put it to you in this way, that he is afterwards applying knowledge he has learned, say in Cambridge, and in that way it would be possible for the technical school at a distance, to select men who had shown themselves really well adapted for the purpose?

3506. Then you would desire that they should complete their training for forestry in some forest school or State model forest?—In the forest itself, I should suggest.

3507. (*Dr. Somerville.*) I suppose that you regard forestry as an important department of rural economy—that is to say, as an important means of developing the financial side of a landed estate?—Distinctly.

3508. I suppose perhaps on the whole you would not place it on quite such a high level as agriculture?—From the point of view of the private landowner per-

Professor H. M. Ward, D.SC., F.R.S.

7 May 1902.

haps not, but from the point of view of the State I think I should.

3509. Perhaps you would express your view as to whether you think forestry offers any special advantages as compared with agriculture from the point of view of State ownership?—It seems to me that there are many large tracts of land which could never be put into agriculture pure and simple unless really paying prices prevailed, and were such as to encourage the conversion, and that could only be over certain shorter or longer times. Land of that sort could very well be planted up, I understand, with trees, and if properly done, if done with a view to a steady and slow future development, as is done in Germany, with the thoughts many years ahead, and the conviction that whatever directions were given would be faithfully carried out, it seems to me that under those circumstances very valuable properties might gradually be developed in this country.

3510. There is in Cambridge at present a department of agriculture, with a Chair: would you suggest that a Chair of forestry should be created?—A Chair of forestry seems to me going too far, if by forestry is meant the technical instruction in forestry, because I think a professor of forestry who was hampered by the want of forests in his immediate neighbourhood, and large forests, must really feel that he has not his workshop at his hand, he has not the appliances that he really needs. If I felt sure that he could obtain forests sufficiently near for him not to feel that inconvenience, it would seem to me immaterial whether he is called a reader, a professor, or a teacher. But I think, from any immediate prospects in Cambridge, he is not likely to be able to find what he really would want at his right hand, as it were.

3511. You have acquaintance with the forest school at Coopers Hill, I believe?—Yes.

3512. The forest school at Coopers Hill, as I understand, has no forests under its immediate control, and yet I think the country as a whole is agreed that the forest school at Coopers Hill is quite successful. Do not you think the condition of things at Cambridge is very nearly analogous to that which prevails at Coopers Hill?—I should not have thought that. At Coopers Hill, I believe, in the first place, it is not quite accurate to say, is it, that there are no forests under its immediate control? There are, I believe, tracts of forest at Coopers Hill which are under the control of the Professor of Forestry. (*Dr. Schlich*: They were till a year ago.) I did not know any change had been made. I understood they were under such control; but even if they were not so, it has always appeared to me that the immediate proximity of a large area of forest which we generally call Windsor Forest, and Windsor Park, is an enormous advantage. Coopers Hill is in the middle of a large forest area. I do not think we could describe Cambridge as being anything like so well situated in that respect.

3513. There may be practical difficulties in the way, but I suppose, at any rate, it is a subject that might with advantage be debated as to whether it would not be desirable to concentrate even the highest forms of forestry instruction, such as are at present given at Coopers Hill, in Cambridge?—Certainly. Personally, I should feel that the more technical parts of forestry offer difficulties which might possibly be got over in debate, but I think many people would feel that the purely technical part of forestry is not a subject for university education.

3514. Yet I suppose we have cases on the Continent where forestry gets more attention than it does in this country, where forestry is taught in its highest forms in a university detached altogether from forests?—True. Of course, the conception of a university abroad and in England is not always the same.

3515. You have acquaintance with the University of Munich, have you not?—Yes; I have a visiting acquaintance. I have been once or twice to Munich.

3516. And Munich is regarded, is it not, as an excellent type of the highest developments of forestry education?—Undoubtedly.

3517. Yet there are no forests under the control of the Department of Forestry in the University of Munich?—Is that so? I was not aware of it.

3518. Is it your impression, then, that the education in forestry at Cambridge should only go to the length of being supplementary to the general education that you consider it desirable to impart to the prospective landlord or land agent?—I should not like to call it supplementary—that does not seem to me the right description—I should call it fundamental. It is the education that is to prepare a man for the very serious profession of forestry.

3519. What I mean by supplementary is this, that perhaps you would not consider that Cambridge was qualified to turn out forest experts, men who were going to make a profession of forestry, on account of the difficulties in the way of technical training?—But they are not yet ready.

3520. But do you think they could be created if the impulse were given?—Certainly. Judging from what we have seen of the agricultural School, I think we might even have men enthusiastically ready to become trained foresters.

3521. You have acquaintance, have you not, with the land within twenty miles of Cambridge?—As a botanist, not, of course, as a forester or an agriculturist.

3522. I suppose it would not be difficult for the University, if the funds were forthcoming, to obtain a certain area of that land as a demonstration plantation?—I think probably not, though I know nothing of details as to any land being available.

3523. In a general way, I suppose, you know that some land not very far from Cambridge is of low agricultural value?—Yes, certainly.

3524. And that so far as the rent is concerned, it would fairly come within the definition of suitable forest land?—Yes. I think we ought also to remember that Cambridge is a chalk and clay county, with the exception of the extreme west—the small border near Potton.

3525. Perhaps you also know that near Woburn there are extensive plantations where the trees appear to grow thoroughly satisfactorily, and which, as a matter of fact, are under systematic management; do you think these forests at Woburn are sufficiently accessible to serve as demonstration objects for any instruction that might go on at Cambridge?—It would be impossible for me to say. I can only remember that Woburn is not on a direct line from Cambridge. Is it not the case that you must go by the London and North-Western line, and then change?

3526. You do not require to change. I think it is about an hour and a half by train from Cambridge?—We are perhaps prejudiced against the line, as we regard the trains as slow, but I cannot say anything that would be of value, I think, with regard to that.

3527. You are quite clear on this point, that if a man is going to prosecute the profession of a forester, or a forest expert, he must have the opportunity of acquiring at least part of his education in a natural practical forest area?—Yes. It seems to me the position is exactly parallel to my own position as a botanist. Without my laboratory I could not possibly work. The forester without his forest is in the position of a botanist without his garden and laboratory, or a chemist without his laboratory. The forest seems to me to be absolutely essential to the forester.

3528. You have, I know, written a good deal upon the application of botany to forestry. No doubt you are aware that the particular mixture of trees is an important consideration in forestry, and that the management of the woods afterwards naturally divides itself into various systems. Without suggesting that it might be possible to acquire three or four thousand acres of land for a forest in the neighbourhood of Cambridge, do you think that these various systems and methods of grouping and even processes of management might be fairly demonstrated upon comparatively small areas within easy access of the class-rooms in Cambridge?—It is impossible for me to speak with any certainty in regard to that, but my impression would be that model illustrations of systems of planting could be devised.

3529. Suppose the recommendations of this Committee were in the direction of the development of forestry instruction in Cambridge, do you think the funds at the disposal of the University are sufficient to carry out such recommendations?—I do not think there

Professor H. M. Ward, D.SC., F.R.S.

7 May 1902.

are any funds that could be applied directly to the foundation of a Chair in Forestry.

3530. Or even as regards the support of the lectureship?—No, not to my knowledge as regards even the support of a lectureship. I may say that within the last few years Cambridge has often founded, at quite short notice, small teaching positions, lectureships, and so forth, but I think it should be clearly understood that these are not calculated to attract anyone from a distance. As a rule the remuneration is small, £50 or £100 a year, to encourage some young man to interest himself further in the subject.

3531. But if the funds were available, do you think the University would offer any obstacles in the direction of the development of a forestry education?—On the contrary, I should think that for the extension of the necessary botanical and scientific teaching the University would quite welcome such.

3532. You, I believe, are at present obtaining large additional buildings for your Department, are you not?—Yes.

3533. Forestry, in certain of its aspects, is very closely related to botany, I suppose?—I think so.

3534. Have you any idea about the development of an economic Botanical Museum, giving special attention to forest products?—There is no special provision for that, though my own intention is to place in the Botanical Museum such illustrations of forest products as we have, and I hope as years go on that that will extend.

3535. Within the limits of your own Department, would you be prepared to encourage the study of botany as affecting forestry?—Certainly.

3536. (*Colonel Bailey.*) You have said, I think, that if a course were established at Cambridge a good many men might possibly attend it?—Yes.

3537. Do you think there is a fair prospect of men attending it?—The actual number of men in the Agricultural School is about 30.

3538. What do you think the aims of the men attending the school would be; do you think they would attend solely for the purpose of acquiring education in forestry, or do you think they would take that course of study as a sort of extra subject along with other things?—I think they would go with the definite intention of taking forestry—if there was such a course in forest teaching—such as would lead to its practice as a profession.

3539. Do you think that a number of other men perhaps could attend, too, who did not come up specially for forestry—but for arts or something else—and who would take forestry in addition?—Yes, certainly.

3540. For instance, the sons of landowners, who perhaps might some day be landowners themselves, and who wish to gain some knowledge of the subject in connection with the management of their estates?—Yes, I think that the sons of landlords, men who have some means and intend to travel, and that those who intend to pursue a definite course of forestry, might be represented in a few years.

3541. You suggested just now, I think, that the teacher in a university, whoever he might be, would want a workshop at his hand. By that you mean, I suppose, a field of practical instruction?—Yes.

3542. That would be an essential?—Yes, I think a forest would be an essential.

3543. There is no forest at the present time in the neighbourhood of Cambridge, I think?—I do not think we can say there is a forest or any woodland that we could fairly describe as a forest. I think perhaps Professor Somerville might help us there, but I do not think we can call any tract of land within 10 miles of Cambridge forest.

3544. If you got a tract of land, and began to stock it for this purpose, you would only have young woods for a very long time?—Yes.

3545. And that would hardly be sufficient for your workshop, would it?—It would not be a complete forest.

3546. It would not be sufficient in itself; you would have to go elsewhere to see other things?—True.

3547. Do you think that the men attending this course would readily go elsewhere? Do you think you could send them, for instance, to Scotland or Germany, or other foreign countries, in order to see what you have not the means of showing them at home, but which is essential to their proper training?—It is impossible to say, as we have never tried it. We have, of course, very small local excursions in my own subject, but that is hardly to be compared with excursions where a man would be away for a month or so. But we find, as a matter of fact, that young men go to Germany and France in their third year, in the long vacation, and study in laboratories, and I think the amount of enthusiasm that is not uncommon in other branches would be forthcoming also if there was confidence in the course of forestry training.

3548. You think there would be no difficulty in giving them the instruction somehow or other. If you could not give it to them locally, you would manage to get them on the ground somewhere else?—I think there would be difficulty; but the difficulty would be such as could be got over by enthusiastic and experienced men.

3549. You are aware, I daresay, that in connection with all, or most at any rate, of the Continental forest schools there are forests attached to the schools as fields of practical instruction, the forests being under the control of the directors of the schools—That was my impression.

3550. The object being to enable the students from time to time during the course of the lectures to be shown what has been spoken about in the lecture room?—That, I think, is of great importance.

3551. It would be rather difficult, would it not, to give effect to the instruction if you had not a forest with trees of all ages and crops of all kinds within accessible distance?—Yes. May I emphasise my previous remark, that I think that would be of importance, by saying that is what I meant by saying the forest is the laboratory of the forester.

3552. You said that you have an agricultural course at Cambridge. Have you a model farm for the practical illustration of agriculture?—Yes; we are very fortunately situated in that respect. We have had a farm placed at our disposal under very advantageous terms, and it is being used, I understand, as a farm for instruction, and I believe I am quite right in saying it is quite adequate for the purpose.

3553. I see that at the end of your statement you have given a syllabus of what you suggest might constitute a course of forestry?—Yes. (*Appendix XVI*).

3554. It contains a number of things—botany, sylviculture, the formation of woods, planting, selection of species, measurement, yield tables, forest utilisation, and forest protection. That would not form part of the ordinary training of a botanist, would it?—No. The course I sketched as a possible course to be completely followed in Cambridge is of such a kind that the parts I have called Part I. and Part II. could be done in Cambridge, and the forestry pure and simple could be done elsewhere. I should like to say that I am not speaking as a forester. In fact, I ought to have put in my syllabus that I have practically taken this schedule of forestry from Dr. Schlich's course as an illustration of what would be possible, not necessarily of what I think should be taught.

3555. I asked that question because I notice that you say that a forester's training should be essentially that of a botanist. It struck me that all the things I have mentioned do not form part of the training of a botanist at all?—May I say that I adhere emphatically to that opinion—that the training of a forester should be essentially an extension of his training as a botanist.

3556. The subjects I have mentioned would hardly come into a botanist's education at all, would they—the formation of woods, planting, sylviculture, etc.?—They are an extension of his knowledge of plants in a technical sense. They do not come under the head of botany.

3557. It would not be part of the training of a botanist?—Not of a botanist pure and simple. I have put it under Part III., and under another head, "Forestry."

3558. You do not suggest that the forester's training should be essentially that of a botanist, and that these subjects are of less importance to him than botany?—No; in their relative place. Perhaps I may put it in this way—that every botanist would not make a

Professor H. M. *Ward*, D.Sc., F.R.S.

7 May 1902.

forester, but a good forester is impossible unless he is a botanist.

3559. (*Dr. Schlich.*) You said just now that it is impossible for a man to be a good forester unless he is a good botanist?—I think so.

3560. How far would you go in that direction? What do you mean by a good botanist from the point of view of a forester?—In the first place he should know the trees of the forests that he is dealing with. He should know a good deal about them, such as he can only learn as a botanist, and he should have that training in botany which enables him quickly to learn similar things about other trees that come within his practice. Then he should have those habits of experiment and observation which he learns so necessarily as a botanist.

3561. Do you mean that he must have a very considerable knowledge of systematic botany?—A selected knowledge, but it must be as good as an agriculturist's knowledge should be.

3562. Do you think that such a scheme as you have been good enough to put before the Committee might be developed at Cambridge for the education of foresters who would find their occupation in this country, or have you anything else in view?—I had essentially in view forestry anywhere in the Empire, but I confess that I did not formulate that view to myself very clearly.

3563. For instance, a forester would go out to a colony, or he would perhaps go to India. He could not possibly get on unless he had a considerable knowledge of systematic botany?—I think so.

3564. But for a forester who is to work in this country do you think this theoretic knowledge of certain parts of systematic botany is quite so essential as it would be to a man who goes to the Colonies or to India, because probably he has only to do with a very limited number of species?—May I put it in this way: that the man who stays in England should know certain facts about certain trees, but the man who went to Ceylon or to Jamaica, for instance, would have to learn similar facts about other species. In other words, what I mean is that whichever part he is going to, he must learn his work properly and thoroughly.

3565. No doubt; and a forester without some substantial knowledge of botany, of course, is not conceivable; but what I want to know from you is whether a great amount of knowledge of botany is required by a forester who is required to practice in this country?—I think the amount of knowledge referred to here is distinctly necessary. Without going through it, my impression is that there is nothing I have put down in my statement which I should like to see omitted from the instruction in botany.

3566. You are looking at it from a somewhat different point of view. For instance, in the detailed syllabus, in the outline and sketch of the forestry course, you deal first of all to a very great extent with general botany. I see that you put down the elements of histology, anatomy, and the physiology of the flowering plants. Then in the special forest botany the details of the syllabus cover two pages; you have the greater part of a page dealing, for instance, with diseases and injuries due to higher parasites, etc., and also to fungi, and you go into considerable detail there?—Yes.

3567. Do you consider that a forester practising in this country ought to have a thorough knowledge of the subjects which you have enumerated there?—Yes, I think that a man who has charge of an important area of forest in this country—that is to say, a chief forester—ought to know those subjects thoroughly, and not be merely acquainted with them. He ought to have been properly trained in them.

3568. How long would it take him to acquire a knowledge of all those subjects which you have entered here under the heads of "Botany" and "Special Forest Botany"?—Two or three years; not less than two and not more than three years.

3569. You also admit that that would only be the botany. You admit, although rather in the shape of an appendix, that a forester should also study some other things. For instance, he ought to study experimental physics, and mechanics, chemistry, geology, and entomology. On the same scale it would take a considerable time, would it not, to study these things?—I am afraid there is a slight misconception. What I have called Part I. and Part II. here are a two or three years' course.

3570. Do you mean that that would include all these things—experimental physics and mechanics, chemistry, geology, and entomology?—Yes. It is being done now at Cambridge. If we read for the present purposes, instead of "Forest Botany," "Agricultural Botany," it is being done in Cambridge now, and that quite successfully.

3571. Do you mean to say a student could master all those subjects in a three years' course?—He could have a very good training in them.

3572. You also admit that over and above that he would require some training in forestry proper?—Undoubtedly, before he could become a skilled forester.

3573. Of course you have a considerable acquaintance with this special forestry subject, but are there not a good many other things to be considered there? For instance, there are forest soils and certain peculiar relations of trees to soil and climate. Then there is the question of the protection of the forest against injuries by insects and against meteorological and atmospheric influences. Then there is the organisation; and amongst other things you have to learn mensuration, and to do a good deal with statistical data, so as to be able to develop the most profitable system of management. The forester will have to make financial calculations in order to find out whether in certain conditions forestry will pay, etc. He will have to determine the method of treatment, the selection of species, etc. He will have to learn to determine the yield of a forest based on a great many statistical data and tables—in fact, learn how to lay down the management in a satisfactory manner. So that if a student takes three years for the first part of the training, do you think you ought to allow less than two years for the rest?—I think it is quite probable that the technical and other part of the forestry would take quite that time in order to place him in a similar position in regard to agriculture in that respect. We made the same compromise with agriculture.

3574. I only want to get at your ideas. As a matter of fact, do you think I go too far if I say that the whole of this study, in order to bring it to a successful conclusion in every respect in which you have pointed out, would practically involve a course of five years?—Yes; because could not parts of this be dovetailed in? With regard to the actual teaching of forestry I am going beyond my own knowledge, but in agriculture they make this compromise.

3575. Do you think that these subjects which you enumerate as the foundation for the whole subject would take a course of three years?—I think the elementary science parts would take at least two years, and that the students might then begin the forestry. I think you are perhaps right in saying it would take two years.

3576. You say that it would take a course of three years for the first part?—I do not put three years as the minimum; I say two or three years.

3577. For an average student?—Yes.

3578. Anyhow, for a complete course it would take something like four or five years. I do not think you could do it in less than that?—If Part III. followed on Parts I. and II. it would take that time, but I think they might begin before.

3579. But you say in one place particularly, although I was not quite clear on the subject, that a forester's training should consist of two parts—"first, education in the principles of the sciences named; secondly, the technical application of the knowledge and thinking power thus acquired to the practical problems of the forest." Then you go on to say the first part can be carried out at school and at the university; the second only in the forest; so that a considerable portion of his education would follow the education at the university?—Yes, certainly.

3580. Then we could not possibly put it at less than four years, or possibly five years?—I do not think it need necessarily be four or five years; at any rate, not more than four. It could possibly be arranged in less, in three years.

3581. Would four years be a satisfactory solution to you?—I really cannot say whether it would take four years. It would take for the part that should lead to a forester's technical education at least two years; it may be three.

3582. It would take a good man two, and the average student perhaps three?—A good man might do it in two years, but the average student might require more.

3583. There are two more points I wish to bring out connected with this syllabus. There is considerable detail given of botany, and mention is also made of chemistry, mechanics, physics, and geology, but it is rather put behind botany. Do you not think that these things, in order to be satisfactory, ought to precede the study of botany. Are not the higher classes of botany based on chemistry and a knowledge of physics, and even soils, and that sort of thing?—Certainly; but we find, as a matter of practical necessity and convenience, that in a university course—for instance, in the sciences of agriculture—the man takes three or four of these subjects at a time, as is done for the tripos. Of course, in putting a scheme in line it looks as if most subjects followed after something else; but they can go slightly parallel.

3584. But the study of botany ought to be started after a certain foundation in chemistry and physics has been laid. At any rate it is easier afterwards?—Yes; we find, as a matter of fact, that very many students who take botany and pursue it a long way, have already done a good deal of chemistry and physics at school, at a school like St. Paul's, for instance, or one of the public schools. They come up to us already knowing something, and they go on with their chemistry and physics at the university.

3585. Then, in your syllabus you give all the details of botany, but you pass over practical entomology in one line?—True. I think I have said somewhere that possibly others would help in drawing up a syllabus. Naturally, I did not feel that I could do more than indicate the heads.

3586. We have had it in evidence here from a very competent authority that the study of entomology is at least as important as the study of botany,[*] and we have had important evidence that the damage done to forests, for instance, by insects, is considerably greater than that done by fungi. Do you not agree with me that the study of entomology ought to be treated at least as completely as the study of fungi, etc., of which you give a considerable amount of detail here?—I am surprised to hear that opinion stated, because it appears to me that, after all, the duty of a forester is to rear and to govern trees, as it were. I should have thought that that was his central object of study; to know the living organisms that he was going to control all through their life, lasting through periods longer than his own life. It seems to me that the trees, the plants are the principal things. It would be a very delightful and useful thing if he knew as much as he could of entomology, but I cannot imagine that that can be looked upon as the primary subject, as is botany.

3586.* The point is this: If he means to do justice to the growing of trees, he must study all the causes which are likely to interfere with the successful production of those trees, and the point at issue at the present moment which I put before you is that the injuries which are likely to occur to individuals under his charge are much more likely to be those caused by insects than those caused by fungi, and therefore it seems to me that a study of entomology is at least as important as the study of fungi, because these insects, especially these injurious insects, will live on those individuals which the forester has under his charge and interfere with them?—Yes.

3587. If that evidence is correct, that at least as much damage, and probably much more damage is done to trees by insects than by fungi, do you not agree that students ought to be as well instructed in entomology as in the attacks of fungi, etc.?—Yes, as thoroughly instructed. It is possible we do not mean the same thing by "thoroughly." Of course, the number of facts that a man must know in any subject must be dealt with by those who are organising the same; but I think the student must know both the subjects very thoroughly indeed, and as much as possible of both.

3588. There is another point which I should like to draw attention to. I have already touched upon the subject in a preliminary sort of way. Do you not admit that there are a great many questions connected with the subject of special training in forestry which could only be solved under the head of mathematics?—No doubt that is so. I am afraid I cannot express an opinion of any great value, but it has often appeared to me that many measurements and so forth could be solved by simpler methods than are sometimes used. But that is only an opinion.

Professor H. M. Ward, D.Sc., F.R.S.

7 May 1902.

3589. Are you aware of the fact that one of the leading authorities on botanical questions in this country has, at a public meeting not more than fifteen months ago, said that Englishmen will not go in largely for forestry unless it was demonstrated that it would return 4 per cent. on the capital invested, and further that only yesterday we had evidence from a most competent authority to the effect that the financial aspect in the last resort will govern the forestry question?—I do not quite understand the bearing of the last statement.

3590. It means that the financial aspect of the whole business will govern the question of whether we shall have more forests or not. If that is so, forestry students must acquire, at any rate, a certain knowledge of mathematics, and a sort of mathematic sense, as I call it, to deal with mathematical questions up to a certain degree. If that is so, would not that add another substantial part to your syllabus; because you do not mention a word about mathematics at all in any part of the syllabus?—True. I am afraid I can do no more than express, as it were, an individual opinion. I have often felt with regard to measurements, as far as I understand them in questions of land and forestry and of agriculture, that simpler methods could be used than are sometimes adopted. It seems to me that these are practical questions that a man with an elementary knowledge of mathematics and a really intelligent knowledge of how to use squared paper and a few mathematical instruments, could get at by very much easier methods than by the complicated formulæ which involve a knowledge of higher mathematics.

3591. We need not go into higher mathematics; only fairly high. If you want to study the laws of increment, which is dependent to some extent on botanical considerations, but is also dependent on a great many other considerations, and production on a large scale in an economical manner, so as to determine the methods which are likely to lead to the greatest quantity of useful produce in the long run, you cannot do that unless you have a certain knowledge of mathematics and a mathematical understanding. We are now coming to the crux of the business. After what most competent authorities, who are acquainted both with botany and forestry, have stated, and considering that the mathematical aspect of the whole business is of the utmost importance to the final success, apart from the knowledge of other branches of science, do not you think that there is really something more in forestry than botany, or the application of botany?—I am perfectly prepared to say that there is a good deal more. I think I am only advocating that a botanical training should be very real, and that it should run on the lines that I say—that it should be taken as the serious foundation as regards the scientific training for a forester. I do not say that a forester is to be a botanist and nothing else. It seems to me that he must have a great deal of knowledge in other directions.

3592. You agree with me, as a matter of fact, that a good knowledge of botany is really the foundation[†] on which he practically builds up afterwards his own profession?—Yes, I think that is my position.

3593. But only the [†]foundation?—It is the most important of the fundamental sciences.

3594. I now come to the expression of a very great authority—a gentleman who was made a Fellow of the Royal Society for his botanical work. He says: "My best friends, men who take a deep interest in the welfare of the British Empire, measure the success of forest administration in India almost entirely by the net annual revenue which the forests yield. When the revenue diminishes, as was the case some years ago in the Central Provinces, such a decrease is regarded as certain evidence of bad forest management." Again he says: "These friends of forestry ignore completely that mathematics, chemistry, meteorology, and geology are

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[*] Dr. Schlich wishes to state that if he used the word *botany* this was a slip, as he meant to use the word *fungi*.

[†] Dr. Schlich does not think that he has been correctly reported. He intimates that he used the words "*one of the foundations*," and not "*the foundation*."

Professor H. M. Ward, D.SC., F.R.S.

7 May 1902.

fully as important to the forester as botany"; and I add thereto, amongst other things, entomology. I do not want to be misunderstood. What I wish to point out is this, that a thoroughly competent forester must have a considerable knowledge of botany; but, after all, it is only one of the foundations upon which he builds up his knowledge of forestry and forest management in the long run. Do you agree with me there?—No, not quite. I agree with you in principle. I do not think there is any fundamental difference between us. It is only as to the quantitative meaning of terms. I should say that it is essentially a botanical training that a forester needs upon which to build up the practice of his art or craft. Even to be a very good botanist he must know a good deal of elementary physics and chemistry. That is always recognised. I quite agree that the other subjects mentioned have their importance, but I think their importance is relative. I do not think this only because it is my profession. I am convinced that botany is the most important subject, though of course I may be biassed in that respect. I should like to say, with regard to the other things—with reference to the definitions of forestry—that I once heard it said, also by an eminent man, that forestry was essentially a branch of mathematics, a statement which I confess was always to me of the nature of a sort of paradox. I do not think that it is a good definition of forestry.

3595. Considering that the whole success of forestry depends on the financial results, do not you think that mathematics has a great deal to do with it? Do you not think that is logical?—Is it the practice of forestry, or is it an assumption of the value of forestry?

3596. No; with the object of determining the best methods of treatment?—I am afraid I cannot say anything of value with regard to that.

3597. I do not care very much to deviate from the line of discussion which we have followed so far; but I should like to mention that on one occasion, at a large party of high officials in Simla, the question of the relation of botany to forestry was under discussion, and a very intelligent gentleman there—he was a high official who was afterwards made Lieutenant-Governor of Bengal —said: "Now, gentlemen, you must not mix up the two things. There is an old saying, 'Make a botanist and spoil a forester.'" It has always appeared to me that because forestry in our Colonies and in India was originally started by botanists—and the thanks of the nation are due to the gentlemen who have done that—the thing has got a little mixed up, and some people have come to consider forestry too much as an appendix to botany. I think we ought to have got beyond that, according to my idea. Starting from botany as one of the principal bases, I think we have developed a branch of science of our own —applied science. The bases of forestry are a series of branches of knowledge, such as mathematics, chemistry, physics, and a certain amount of mechanics. The foundations in the second line upon which I base the science are three—geology, entomology, and botany—of which botany is the most important; and then on the top of that we have built up forestry proper, such as the application of the sciences to sylviculture, forest protection and utilisation, forest management, and all the other works connected with the subject. You would not accept that as a reasonable exposition of the case?—Of course "reasonable" is here an invidious word, but I should dissent from it. I should put it in this way, if I may. We regard the science on which a doctor's education is based as anatomy, the structure of the human body; we regard the fundamental science on which a miner's education is based as geology; and I think we regard the fundamental science on which the education of a man who is going to take care of plants is based as botany, the structure of plants. I think the central science on which an art or craft is based can generally be clearly stated. In this case I think it is clearly botany. There are plenty of other illustrations. We should say the same with regard to almost any special craft. The great training of an engineer turns on the construction of an engine. The fundamental point with him is not the accessory parts of mathematics which he has to use. He has to use a good deal of that: but undoubtedly his fundamental science is physics, mechanics, and their application to the structure of engines.

3598. And mathematics?—Yes, there is a good deal of mathematics required.

3599. But you cannot study physics without mathematics?—True; nor can you study botany in all its aspects without mathematics.

3600. It has been applied very considerably of late to botany?—I think it is the same with many other things. There are many crafts and arts where chemistry is obviously the central science, but I think it is perfectly clear, in my mind, quite apart from prejudice as a teacher of botany, that all one can know about the plant is the fundamental part of the whole subject of technical forestry.

3601. You have given us as an example that the organism of the human body is the foundation of the study of the doctor. Would you think it a doctor's business to study the multiplication of the human race to produce as dense a population as possible on a given area, to grow as many men and women on a certain area so as to have the largest possible production in the way of population that you possibly could have?—True; but unfortunately, when dealing with men, other difficulties come in; but supposing he was a breeder of animals, he would have to do that.

3602. In a certain way; but in the case of forestry it is not so much the individual plant. There comes in the economic aspect, to produce the greatest quantity of timber of a certain description under the most favourable conditions, and that obscures a little the botanical aspect of the question?—It seems to me that that is an extension of the subject, that the forester has to apply botanical problems in particular ways. I have already recognised that.

3603. He may have to set aside altogether many botanical considerations with regard to individual plants?—Undoubtedly.

3604. For instance, he may have to squeeze his tree into a narrow shape, instead of allowing its natural development?—Yes, certainly. I am not saying that he should study every aspect of botany; I am selecting certain aspects of botany. I simply say that botany, as far as botanical training goes, is of fundemental importance.

3605. We all know that a forester must have a considerable knowledge of botany. The only thing I wished to point out was that, according to my opinion, there were other things fully as important as the study of botany?—Just so.

3606. (*Professor Campbell.*) There is one point on which you are quite clear, namely, that you would first of all train a man in the sciences at the University, but he would have to go to a forest for practice?—I do not think there is any doubt about that.

3607. Do you consider forestry as a suitable subject for higher University education?—I draw a distinction between forest science and forestry when it has gone past a certain stage. It is then the application of educational subjects. I think it would be perfectly fair to ask a University to train a forester up to a certain point. Then the technical forester takes him in hand, and I do not think the University could do that, it must depend so much on the ability, the experience, and the opportunities of the technical forester; but it is no longer then an educational subject in the wide sense of University training. It is now an essentially technical subject, by means of which the quickest and most profitable returns must be obtained as best they may.

3608. Of course, the same applies to agriculture, does it not?—I think so.

3609. Agriculture has been made the subject of university education in this and in foreign countries?—Yes. We call it in Cambridge, it will be noticed, the Agricultural Sciences, and I think we draw the distinction (though some would be prepared to go a little further), though we are in the minority, I am afraid.

3610. The student would obtain his technical knowledge in the forest?—I think he must.

3611. You would divorce him from the college or the University altogether during the last two years of his course?—I think it would have to be that.

3612. In submitting this scheme, do you wish it to be taken as evidence of what a course in forestry should be, or simply as the best that could be done at Cambridge?—I thought it might be taken as an outline course of what I should regard as a good course in forestry. I ought perhaps to have said in my statement somewhere: with regard to Part III., I am really dependent on Dr. Schlich. I have practically taken this from the syllabus at Coopers Hill, with which I was fairly familiar, but with regard to the rest, I have thought it out a good deal, and it seems to me to be

Professor H. M. Ward, D.SC., F.R.S.

7 May 1902.

a kind of course that should be aimed at. I should like it to be quite clear with regard to Part III.

3613. The first part of the training would be the study of botany, chemistry, mechanics, physics, and geology?—Yes.

3614. You do not include zoology, I see?—I do not include zoology. I felt that something should be done here very much as we do in agriculture. There is subsequently a class in entomology, and perhaps it throws on the entomologist the responsibility of teaching the students elementary zoology. I am quite prepared to admit that in an ideal course a little zoology should come in, but I was trying to deal with it practically.

3615. But I take it that his course in Part I. is the ordinary course given in the University for, say, medical students, or at least for science students?—Yes.

3616. There is no direct reference to forestry here?—There is no direct reference except on the part of the Professor himself.

3617. But you would not expect the Professor to make any direct reference to forestry, seeing that he is teaching a number of students that attend for another subject?—As a matter of fact he does so, although we do not teach forestry. I still pay a good deal of attention to matters of interest in forestry, and also in agriculture, in my elementary lectures.

3618. With regard to chemistry, you would expect that applied chemistry, chemistry as requisite for the forester, would be given in the chemistry class, and similarly with mechanics, physics, and geology; but you regard botany as of such importance that you could not possibly give all the applications in the elementary course?—That would be impossible.

3619. It is for that reason that you set out applied botany under a separate heading, and give an illustration of the subjects that you teach?—That, I think, fairly expresses it.

3620. How many lectures does Part I. involve in each of the subjects?—I cannot say, of course, with regard to any other subject but my own.

3621. Is it a substantial course?—Very. It involves something like 60 lectures, and twice that number of hours of practical work, besides work in the field.

3622. Then in Part II., forest botany, have you any means of knowing how many hours that would require?—That we do not do; that would have to be worked out, and it would mean a good deal if properly done. It might mean at least two lectures a week for two terms, and twice that number of hours in the laboratory.

3623. Then as to Part III., you do not profess to give authoritative evidence?—Not on Part III.

3624. That should be given in the forest school?—Yes, that is the technical work in the forest.

3625. Have you in your mind the training of foresters or land agents or landowners?—Foresters, I think. I quite see that a land agent who only comes incidentally in contact with woods might not need so thorough a training, but that, of course, would be likely to remove it from the curriculum of the University.

3626. The point that occurs to me is that you are not likely to have foresters attending these classes at Cambridge in view of a forester's small remuneration. The stipend of the forester, as you know, is very small and the cost of living at Cambridge is pretty high?—I cannot give you details at once, but they can be obtained for you; I believe that difficulty has been got over to a large extent in the agricultural school. I think you will find on inquiry that they have solved the expense difficulty very fairly.

3627. Have you met a number of practical foresters?—Yes.

3628. Do you intend that the practical foresters, the men that you have met, should take this particular course?—Yes, that is chief foresters. I mean men who attain dignities which Dr. Schlich has gone through many years ago and superseded. I should say that they ought to be quite as thoroughly trained as is here implied.

3629. For example, foresters in charge of the woods of a fairly large estate?—Yes. On some of those large estates that I have seen, such as the Duke of Athol's in Scotland, and so forth. It seems to me that such estates ought to be under the management of men who have a very thorough training indeed.

3630. Does it not occur to you, as it does to me, that these practical foresters, at any rate, if you turn out a large number of them, would be much better foresters if they received their training in a forest school, where you could have the class rooms attached to the forest?—I think that is possible.

3631. It would be much better to remove forestry out of the University curriculum altogether, except a course for landowners who are there for a liberal education?—Yes. We must not forget that the circumstances would not decide it entirely; so much depends on the men and the teachers. If you can get together a series of teachers, such as some of my colleagues in Cambridge in a school of that sort, that is undoubtedly the ideal arrangement, but it must not be forgotten that it involves a good deal. It has grown up slowly in an old University. It is not made by merely offering small salaries to men you come across.

3632. You do not agree with me, then, that a good teacher of natural science together with a good teacher of practical forestry would be enough at a forestry school for young foresters who expect to obtain salaries of 80*l.* to 100*l.* a year?—If you mean that the teacher of natural science should take up four or five branches, I should deprecate that strongly. I go so far as to say that I think the more elementary the teaching the more thoroughly experienced the teacher should be. It has always appeared to me that it is the duty of the most experienced teacher to take the elementary courses.

3633. Quite so. I agree with you entirely in that; but in view of the demand for skilled foresters, and in view of the necessity of getting them interested in the subject, do you not think that if we are to rely upon these higher centres of instruction it would be a long time before we got our foresters trained; and that a school such as I am foreshadowing might be better at any rate for the rank and file of foresters?—I would put it in this way rather than that. I would have a technical forest school and would send to Oxford or Cambridge or Edinburgh, where men have been trained in this preliminary science, and have just taken their degrees and want something to do, and ask them to come. You would get them if you offered them a year's training in the technical course, if there was an opportunity of their subsequently getting even low salaries—a living wage.

3634. You are quite clear that it would be a mistake to have a small forest school with a few class rooms where young men who are aspiring to the position of head forester could receive instruction in the sciences underlying the practice of forestry as well as in practical forestry itself?—If you rely on teaching in that school all the preliminary subjects and the fundamental subject, I think it would be quite a mistake.

3635. In fact, you would rather see a man receive nothing but a training in practical forestry?—Yes.

3636. (*Mr. Stafford Howard.*) I think in answer to Dr. Schlich you said that assuming this scheme which you suggest in your memorandum was accepted it would take from two to three years for students to go through it?—Yes.

3637. That is having regard to the present length of University terms, assuming that all the instruction would be given within the period of those terms?—Yes.

3638. It is not unusual, is it, for some students who are interested and keen in their work to utilise the long vacation?—That is done regularly.

3639. Assuming there was a State forester available, would it not be possible that a portion of a long vacation might be used by students to take up Part III.?—I think so.

3640. It is not at all necessary that the lectures and instruction in Parts I. and II. should be given by the same person as the instruction in Part III.?—No; that would be a practical illustration of what I mean by dovetailing the courses.

3641. So that students might get the three parts within the three years if they devoted a certain portion of the long vacation to instruction in a State forest, assuming one were available?—Yes, that is so.

Mr. J. Parry.

7 May 1902.

Mr. Joseph Parry, called; and Examined.

3642. (*Chairman.*) You are Chief Engineer to the Liverpool Corporation Waterworks?—Yes.

3643. Can you give the Committee some information as to the extent of the area from which the water supplies are collected in Great Britain for large towns?—The water supplies of towns and villages are derived from three different sources, rivers, wells, and catchment areas, from which the water is collected into reservoirs. With regard to the wells, of course, we have nothing to do here to-day, and in regard to river supplies I propose to say very little, simply to call attention to the fact that a very large part of the water supply of the country is derived from rivers, as in the case of London, where water is pumped direct from the Thames and Lea. In such cases the local authority or the water company have control of the works, but possess no power of any kind whatever over the gathering ground. They differ from the cases to which I propose to call special attention in this respect, that the river supplies are taken from an area difficult to define, and an area over which it has never yet been proposed that any control should be exercised in the interests of the water authority. I can only give you the figures very roughly, but there are probably altogether 14,000 square miles of country in Great Britain drained by rivers above the points of intake from which the water is pumped for the supply of towns. That includes, of course, a very large area (3,542 square miles) from which the companies taking water from the Thames derive their supplies. In passing I may just observe with regard to those river areas that increasing attention has been given of late years to the sanitary condition of these gathering grounds, and it appears to me pretty evident that sooner or later the rivers must either be abandoned as sources of supply, or some means must be taken either by reducing the resident population, or by stringent sanitary measures to purify the sources. However, I pass by the river supplies, and come to the more special case of the reservoir gathering grounds. The catchment reservoirs which are formed for the purpose of collecting waters from upland sources for the supply of towns and villages are, of course, numerous. There are a great many cases of the kind, and I have not been able during the time at my disposal, to get for the Committee complete information with regard to the areas that have been assigned to the different towns of the country, but approximately, I think you may take this—I hope to give more accurate figures hereafter—that the gathering grounds in Great Britain contributing to reservoirs constructed for waterwork purposes amount to something like 900 square miles, or 576,000 acres. Perhaps a few examples of these would interest the Committee. For instance, Birmingham has 45,560 acres; Bradford, 27,970; Liverpool, 32,742; Manchester, 30,220; Derwent Valley (a recent case), 31,600; Newcastle, 6,000; Glasgow, 25,752; Dublin, 14,080 acres. Those are included in the figure which I gave you just now of an approximate total area of 900 square miles. That is to say, an area of about 576,000 acres has to a large extent come under the control of local and other water authorities to collect and impound the streams flowing off that area for waterworks purposes. The next point I have down to call attention to is with regard to the character of those gathering grounds. For the most part, indeed, with very few exceptions, the gathering grounds are in districts very sparsely populated, hilly districts, and districts to a large extent particularly and peculiarly appropriate for growing timber. The statutory provisions for preventing pollution of the water, in which these water supply authorities are naturally very much interested, have hitherto been of a very inadequate character, and the attempts that have been made by bye-laws, by regulations, and by putting into operation the clauses of the Public Health Acts and the Prevention of Pollution Acts, have failed for the most part to protect the water from being polluted in a manner likely to be injurious to health, with the result that for some years now there has been a growing feeling in the country among waterworks engineers and water authorities generally, that it is essential in order that the domestic supply may be preserved from contamination that the water-sheds, the drainage areas contributing to the reservoirs, should be entirely under the control of and therefore owned by the waterworks authorities. I think the first example of powers being given by Parliament to acquire a water-shed for that purpose occurred in 1879 in the case of Thirlmere, for the Manchester supply, where the whole of the drainage area was purchased by the Corporation. Liverpool followed in 1880, in connection with its Vyrnwy supply, and was authorised to acquire by agreement the whole of its new watershed. More recently the difficulties of acquiring watersheds by agreement have led a considerable number of towns to apply to Parliament for compulsory powers, and at this moment I am engaged for Liverpool in promoting a Bill which is before a Committee of the House of Commons to acquire a water-shed at Rivington, of 10,000 acres, from which Liverpool has been partly supplied for the last 40 years. I think no recent Session has passed without one or more Bills being before Parliament from important corporations for similar powers. I can refer you to Leeds, Halifax, Bradford, and a number of cases of the same kind, and I hope to be able to send the Committee a complete list of those cases at a later stage. Of course, the question arises naturally, and has been the subject of discussion within the last two or three days in the Committee on the Bill to which I have just referred: What is to be done with these areas when they are acquired? How are they to be utilised? Is it proposed to depopulate them, pull down the residences and farmsteads, or in what other way are these large areas to be dealt with? One conclusion seems gradually coming to be arrived at by all experts in these matters—I mean more particularly the medical experts and bacteriologists—that no use of a water-shed which involves the existence of a considerable number of human beings in farmsteads or residences can be held to be consistent with the maintenance of a high standard of purity in the water supply, and that necessarily and obviously leads to the further conclusion that the farms and other residences must to a large extent be pulled down. Then the question arises, What is to be done with these areas? And it is at this point, I think, that the question becomes one of very considerable interest to this Committee, because I have for some time arrived at the opinion that no more useful appropriation could be made of those water-sheds than to apply them, at all events to a very considerable extent, to the purposes of forestry. It seems to me that those areas are eminently suited for planting, and that it would be a method of utilising the water-sheds which would both contribute to the yield of water, and would effectually prevent any pollution taking place, and at the same time would bring to the local authorities—and this, from their point of view, is an important consideration—some reasonable amount of return upon their capital outlay in the purchase of the lands. I may say that one of the difficulties hitherto experienced in connection with the purchase of water-sheds has been that in proceeding upon commercial principles and on commercial lines, it has been extremely difficult, in fact, almost impossible and hopeless, to acquire by agreement the ownership of the lands, and when they are acquired compulsorily it means that costly arbitrations have to be held, and amounts paid as compensation for which no adequate return in the shape of annual revenue from rents can be obtained. So much by way of general observation. Now I come to the special question of Liverpool, of which I can speak, of course, with greater authority. Perhaps it would assist the Committee if I put before you a plan which shows Lake Vyrnwy, the artificial lake formed by the Corporation under the powers acquired by them in the year 1880. That lake nearly five miles long, with an average width of about half a mile, the maximum being three-quarters of a mile, has a direct drainage area of 18,500 acres. There are two adjoining areas which Liverpool has power to collect and convey into the same lake, but with respect to which the works for diverting the water have not yet been completed, so that for the moment I am dealing only with the 18,500 acres draining directly into the lake. The green colours on the plan show the position of the plantations to which I shall refer more fully. Bearing upon the question of the planting of trees upon that area, out of a total of 18,500 acres there are 1,000 acres between the top water line of the lake, which is 825ft. above Ordnance, and the 1,000ft. contour; 2,000 acres between the 1,000ft. and the 1,250ft. contour; 3,600 acres between the 1,250ft. and the 1,500ft. contour, and 8,000 acres between the 1,500ft. and the 1,750ft. contour, the rest of the drainage area being at a still higher elevation. That will give the Committee an

Mr.
J. Parry.

7 May 1902.

idea of the extent of the ground available for planting purposes. In the first instance, the Corporation, when they became the owners of this land, authorised certain planting operations, I may say almost entirely for ornamental purposes; that is to say, it was not with any deliberate intention of growing timber for any useful or commercial purpose; it was for ornamental purposes, and also to some extent for estate purposes. But proceeding upon that principle and method, the planting was not very successful. The trees were planted far too widely apart. Those who designed the planting thought that by just planting a clump here and there, and a tree here and there, they could produce a beautiful landscape effect, overlooking altogether the fact that Nature would not allow the trees to grow under those conditions, and I am afraid a good deal of money was spent without any very satisfactory result. That will, I think, bring you to the point at which, in the year 1894, I got a report from experts in Cheshire, a firm of large experience in the cultivation of trees, with regard to the state of the plantations on the Vyrnwy water-shed, and on the subject generally. I acted for some time on the advice given in that report, but not being quite satisfied with the result, I was put into communication in the first instance with Dr. Schlich, and subsequently with Mr. Fisher, of Coopers Hill College. He came down and made a report, which I will put in, to the Corporation, dealing very fully with the entire subject of the plantations, and their condition, and giving very full advice as to the methods of treatment to be adopted in the future. The recommendations have, almost without exception, been carried out, and with considerable success. I shall be prepared to answer any questions the Committee may desire to put with regard to the results obtained, but I first hand in a statement (*Appendix XVII.*) showing the trees that have been planted during the last five years, since the date of Mr. Fisher's report, from which it will be seen that altogether we have in the period named planted 162,260 trees in the Vyrnwy plantations, that is, in the plantations shown on the map. Considerable importance was attached by Mr. Fisher to the establishment of nurseries for the growing of our own seedlings, and under his advice I added to the nurseries then existing. At the present time I have three nurseries, with a total area of 8,200 superficial yards, one containing 1,700 yards, another 3,400 yards, and another 3,000 yards, and in those nurseries at this moment I have a total number of something like 231,000 young trees ready for planting out. Perhaps it may interest the Committee to have a statement in detail of the plants now in the nurseries. (*Not printed.*)

With regard to expenditure, and still confining my remarks to the last five years, we have spent on the nurseries proper a total of 300*l.* only, and the total expenditure on the plantations, I think, has been at the rate of about 200*l.* a year. The staff I have comprises the forester, the man in charge, and a gang of three, four, or five men, according to the necessities of the season. One of the principal difficulties I find in utilising timber from the Vyrnwy plantations is that of cartage. There is no station nearer than ten miles off, and the intervening country is hilly and difficult for traction, with the result that cartage is a very expensive item. I cannot get more than something like about 4d. a cubic foot for fine larch timber on the margin of Lake Vyrnwy, while if I had the timber at the railway station, ten miles off, I could probably get 1s. and 1s. 3d. per cubic foot. At an early date my attention was given to this point, and it seems to me clear that before I can hope to carry out successfully any large timber growing operations around the lake, which I hope to do in the future, I must devise some means of utilising the timber to a greater extent locally; that is to say, I must put the timber into such a state as will reduce the amount of cartage by making it, as far as possible, of commercial value on the spot where it is grown. In that connection the question arises in what way, and to what extent, mechanical power is obtainable for the purpose of developing local industries, and of utilising timber for different objects. In connection with all waterworks undertakings of this character there is first of all an item of what is called compensation water; that is to say, the water undertakers, in consideration of being allowed to impound the streams from the watersheds, come under an obligation to discharge to the rivers which are affected a specified quantity of water day by day throughout the year, which is called compensation water. That compensation water has to be given out of the reservoirs where it is collected. In the case of Lake Vyrnwy, Liverpool has to give a daily compensation throughout the year of 10 million gallons to the river, and periodically, in what are called freshets, during eight months of the year for four days of each month, a volume of 40 million gallons a day, making a total of 50 million gallons per day for 32 days of every year. That water going out of the reservoir or lake from a considerable elevation above the river level at the foot of the dam means that there is a considerable amount of motive power which can be made use of for some purpose or other. In the particular instance of Lake Vyrnwy, we have a daily horse power available from this compensation water alone of from 100 to 150 horse-power, and the additional power available from the special freshets I have described, if it could be utilised, represents something like 400 horse-power. I see no difficulty in this instance, as in other similar cases, of utilising that power, electrically or otherwise, for forestry purposes. That is to say, to begin with one would have a saw mill, where the timber could be cut up into the various sizes required, and what I should desire would be that within a reasonable distance, at the nearest available spot, there should be established village industries, where either bobbin-making or some of the other numerous uses of wood with which I am sure the Committee are more familiar than I am, could be carried on, and I see no reason why, in that way, not only should the watershed be utilised advantageously for the growing of timber, and the timber afterwards converted into a marketable commodity, and at the same time a very great amount of benefit done by giving to the rural populations what they so much need, some occupation in the shape of village industries. I suggest that scheme, in rough outline, as being, in my own mind, a desirable state of things to bring about eventually. This Vyrnwy reservoir is, of course, new, and up to the present time nothing has been done because the plantations are in a very early state of growth, and are not yet sufficiently developed to justify any expenditure in the direction I indicate. Generally speaking, scarcely anything has more impressed itself upon me in connection with this subject of timber growing than the great importance of trying in some way to utilise it locally, as near as possible to the point of growth, because I see that in a great many instances which are within my own personal knowledge the difficulty of utilisation arises from the cost of cartage. I can refer you to plantations now, which have attained to full maturity, where there is very valuable timber, which could be sold with great advantage if it were at a railway station or near to a large town; but owing to its distance from a station, and owing to the difficulty of access, it is almost worthless. The next point on my notes to which I desire to call attention is the difficulty I have myself experienced, and which I know to exist to a large extent, of obtaining the services of skilled foresters. I have had to make several changes in the men in charge since the Vyrnwy works were completed, and I have found the greatest difficulty in getting suitable men to take charge of the planting. It seems to me that there is a very large field for the training of men skilled in timber growing, and that a great deal more might be done than is being done now in the way of qualifying men for such work, especially for the work of an ordinary forester—I mean a working forester—by some system of apprenticeship or otherwise. The want of technical advice, guidance, and knowledge on the part both of local authorities and of landowners, with regard to the proper methods of timber growing, I think points very clearly to the necessity there is in some way or other of diffusing information on the subject, and of placing within the reach of those who have the opportunities of planting timber really good expert advice and guidance. I think that is a very great want, and that the failures which have occurred in so many places, and of which I know some instances, and which are due to the want of proper technical skill and experience, have deterred a great many people from spending what they otherwise would have been disposed to do. I think I have stated broadly the points I wish to bring before the Committee; I shall be very glad to enter more into detail if desired. I have omitted to give you one figure which is perhaps of importance, namely, that the total area of plantations shown on the drawing, and now in the possession of the Corporation, is 470 acres.

3644. Do you intend to go on planting until the ground which can be profitably occupied by timber is fully stocked?—I do to a considerable extent. I may

Mr. J. Parry.

7 May 1902.

say on that point that no definite decision has been come to on the part of the Corporation, and when I say that I desire to extend the planting to a very much larger extent than at present I am rather giving expression to my own individual opinion than to what I know may be the view of the Corporation when the matter is put before them in the shape of a report or a recommendation.

3645. You have found experts to advise you as to a general plan without any difficulty; your trouble is with the working forester in charge?—No, not quite so. I found considerable difficulty in getting expert evidence in the first instance. The expert evidence upon which Liverpool relied up to the time named by me when I saw Dr. Schlich was expert evidence of the usual kind—the expert evidence of nurserymen and of those to whom people usually apply for guidance in the matter of timber growing.

3646. But there are plenty of men in the country who are competent to give advice if one only discovers where to find them?—That is precisely the difficulty. If anybody could be said to be in the position of being able to get guidance and the best expert advice I was in that position when I applied some five or six years ago to the Office of Woods and Forests, but it was not until I was put on the track, so to speak, of Dr. Schlich, that I got to know of the assistance I could get from his Department. I made an application to him, and subsequently advised the Liverpool Water Committee to allow me to ask Mr. Fisher to come down and spend some days at Lake Vyrnwy, and make a report. Very few corporations and very few landowners would go to the trouble and expense of doing anything of that kind. What I suggest to you is that it is really necessary that people should be educated in this matter, and should be advised to seek competent guidance in carrying out their operations.

3647. (*Mr. Stafford Howard.*) I understood you to say that Liverpool acquired this large area—I forget how many thousand acres—by agreement?—Yes.

3648. You had no compulsory powers?—No.

3649. Did you find much difficulty in coming to an agreement?—No, except in one case we did not, because we were fortunate in being able to deal with large landowners, such men as the Earl of Powis, and others, who readily acceded to our desire to become possessors of the watershed. But I may add that other towns have not been as successful as Liverpool, nor have we been as successful at our Rivington water-shed in Lancashire as we were at Vyrnwy in Montgomeryshire, and consequently other towns as well as Liverpool this session have been obliged to apply to Parliament for compulsory powers, and the disposition of Parliament now is to grant those powers readily to any town seeking them. Further, I may say that after the Maidstone disaster, some few years ago, the Local Government Board issued a circular to all local authorities, in which among other things they strongly advised that the towns should become possessors of their own water-shed areas.

3650. In this Liverpool area had you any case where one man was the lord of the manor and other people had the right of grazing over the land?—Yes, there was a lord of the manor, but we acquired all the manorial rights.

3651. After that you had to deal with the individuals who had the grazing rights?—That was an easy matter.

3652. They did not object to sell?—Perhaps I should explain that the bulk of the planting was below the point at which those grazing rights would come into operation.

3653. Are the grazing rights still in existence over the greater portion?—Yes, over the higher lands.

3654. You have not acquired them all?—We have acquired them, but the tenants, who are our tenants had certain grazing rights which they acquired from the lord of the manor, but which would not interfere now with any extended operations in the way of planting, because we are the owners.

3655. In fact you acquired the whole rights?—Yes.

3656. Both the lord of the manor's rights and the farms round the commons, together with the grazing rights attached to those farms?—Yes.

3657. What sort of price had you to give for this land—an agricultural value?—We gave a fair agricultural value.

3658. You do not think you gave an extravagant price?—Not by any means. We gave a very fair price for the land.

3659. If you had been acquiring it solely for the purpose of planting, would it pay you to plant, quite apart from the water question?—No, I will not say that. I do not think it would pay us quite apart from the water question. First of all, taking into consideration the necessity of preventing the pollution of the water somehow or other, taking into account the difficulties there are in conducting ordinary farming operations without causing pollution of the water and all attendant circumstances, it seems to me there is no way of utilising the land better than by timber growing.

3660. I quite agree. It came in as a secondary consideration, after having obtained the area for the purpose of the water supply?—Necessarily.

3661. Then with regard to the distance from the railway station, have you much mature timber there?—No, not much. The figure I gave you had reference to one old plantation, which is fully matured, and is ready for sale.

3662. You found that you could get practically no price because of the expense of transport?—I asked for quotations from the timber buyers in the district, and the quotation I obtained was the figure I named to the Committee, namely, 4d. a cubic foot, as against 1s. to 1s. 3d. at the railway station.

3663. If you could acquire a large area and grow a considerable quanity of timber, it might be worth while to improve the access. Supposing, eventually, you plant a great deal of this area, and you get a large quantity of matured timber, it might then possibly pay to make a good road?—It might possibly pay, but still I think a good deal more might be done than has been hitherto attempted in this country in the way of locally utilising the timber.

3664. I quite agree with you. You have the water-power?—Yes, and we have a great many natives around who are not fully occupied, and whose tendency is to go away to our big towns, because they find the villages not attractive enough for them, and not capable of affording sufficient scope for their labour. I think it would be of great advantage if the men could be retained in the neighbourhood by giving them some occupation of this character.

3665. Are you aware of any towns which have these big water-sheds which are following in your footsteps in this matter?—I have received enquiries from some towns, and I find that where they have acquired water-sheds the question now presents itself to them, What are they to do, consistently with the maintenance of a high standard of purity of the water. We are, I think, leading the way in the matter. The Birmingham works are not quite completed; they have not got so far as we have.

3666. Have you laid out any regular scheme of successive planting to cover a large area, or is it still rather only tentative?—It is still only rather tentative. I have ideas on that point which I have not yet been able to develop, and which are too immature to put before the Committee.

3667. You want to see how these preliminary plantations get on before you involve the Corporation in a large expenditure for a larger scheme?—Yes. I am glad to say that so far the recommendations we had from Mr. Fisher have proved eminently practical and valuable.

3668. (*Professor Campbell.*) What is the character of the surface of the land?—The geological formation of this particular area is the lower Silurian; what is commonly known as bastard slate.

3669. I mean the immediate surface?—It is a thin, rather poorish soil.

3670. Agriculturally, what is it worth?—Agriculturally it is only useful for sheep grazing for the most part.

3671. There is no tillage?—There is no tillage on that part.

3672. There is none on the area at all?—There is none on the area which we have covered.

3673. What kind of trees are you planting?—The statement put in will give you full particulars with regard to the character of the trees.

3674. One part of your evidence, where you show how absolutely necessary it is to clear the ground of people, does not seem to me quite to agree with your subsequent desire to keep the people on the area and to create village industries?—I am glad you called attention to the point, because my suggestion is that these village industries are to be below the water-shed, entirely off the water-shed. That is a most important point. I may also add that the utilisation of the water power would necessarily be at a lower point.

3675. Do engineers ever consider it necessary to have instruction in forestry?—No, except those who are thinking of going to India, and go to Coopers Hill.

3676. Would it be desirable if a course of forestry were available for them?—No, I think not. I think it would be very much better that men should be trained specially for forestry. What I would like to see done is something of this kind. I should like to see boys and young men apprenticed to the practical foresters in such places as Vyrnwy, who would spend a considerable part of the year working in the forests and assisting with the forestry. Then for a term or so in each year I would suggest that they should go to the nearest university college, or good technical school for instruction in the science of their calling. For example, near Vyrnwy there are the University Colleges of Bangor and Aberystwyth. I would wish that these young fellows should be able to get at those colleges the fundamental scientific knowledge required. They should be apprenticed to the working forester during two-thirds or three-fourths of the year, and for the rest of the year should attend classes and lectures.

3677. The practical and scientific education should go on together?—Yes. I should make a distinction very much in the way we do in my own profession of civil engineer. Civil engineers who follow the profession as a profession must, of course, receive the highest possible training in mathematics and physics, and all sorts of allied sciences and arts, and in like manner I would train the men who are to follow forestry as a profession; but we have another class of men who are employed as mechanics in our works and in other capacities as artisans, who first serve an apprenticeship in the workshops at a low rate of remuneration. They serve an ordinary apprenticeship, just as a brick-setter or a mason would. It is with regard to such men that I more particularly make this suggestion. I should like to see a lot of the youths of the working class trained as apprentices to practical forestry during part of the year, and facilities given to them to go to the college during, say, one term a year, for the purpose of acquiring technical knowledge that would be useful to them in their occupation.

3678. I think you said you have handed in Mr. Fisher's recommendations as well as the report?—I have handed in the whole report, and if the Committee care—I do not know whether it would be of any use—I should be glad to give the earlier reports from other sources; but I do not know that they would be of much assistance to you.

3679. (*Mr. Stafford Howard.*) Did you remove a considerable number of houses and population from the site you have referred to?—Yes, we removed a whole village, 40 houses, with a church and two or three chapels.

3680. A good deal of the land round the lake which is now being planted was used by them for grazing purposes?—Yes.

3681. And therefore, as you have removed the people who used that land, there is now nobody who wants to use it except yourself?—There is somewhat of a hunger for lowlying land on the part of these sheep farmers, because they can send their sheep on to the hills during the summer weather, but during part of the spring and autumn they have a difficulty about wintering, and therefore they want as much lowlying land as they can get.

3682. That they are deprived of?—Yes.

3683. Having taken away a great many of the farms which originally used some of the lowlying land, you are occupying the whole area, and therefore that question does not arise?—We have not taken all the farms. The inhabitants of the villages were mostly the ordinary class of villager—labourers and shopkeepers. There was not much land attached to their houses. We have taken very few farms. What we have done in that way has been mainly the removal of farms from the valley up to sites above the water line, free from danger to the water.

3684. You have deprived some of the farms of their low grazing lands?—Yes.

3685. And they find there is a difficulty in managing their farms?—Yes, that is so; we have had to reduce the rentals accordingly.

3686. (*Mr. J. H. Lewis.*) I understood you to say that you had not found very much difficulty in arranging with the farmers who were deprived of their grazing rights?—Practically no difficulty.

3687. They were satisfied with a reasonable compensation?—They readily fell in with the suggestion that the allowance to be made in respect of the land that had been taken away from them should be settled by arbitration.

3688. Did you consider in reference to the plantations that have already been grown, and which will be grown, that they will derive any advantage from the shelter which the plantations will give?—I think they will, and they do already. I may say that I have received frequent applications from the farmers to plant trees around their houses and farms for shelter.

3689. They are learning, then, to appreciate the advantages of forestry. You are acquainted, I think, with other parts of North Wales as well as with this particular catchment area?—Yes.

3690. In the course of your travels in North Wales did you observe, interested as you are in this particular subject, any considerable areas of land which could with advantage be afforested?—Yes, very large areas which could be utilised for this purpose with great advantage. In putting the matter before the Committee I have confined my observations entirely to watershed areas, but, generally, I do know as a matter of fact that there are considerable areas where it would be a great advantage to encourage forestry and to plant trees.

3691. Are you also aware that there is a considerable amount of water power in North Wales which could be utilised, if the industries of which you have spoken were created in connection with the forests?—Yes. The great need I find to exist is the need of some expert and sound advice on these subjects; that is to say, people do not know quite where to go, and they just leave matters to take their own course. They do not know where to go for safe advice, and they do nothing.

3692. You mentioned that the people living on the soil were not fully occupied throughout the whole course of the year: do you consider that forestry would help to fill up the workmen's year, and that it would give them more continuous occupation than they now have?—I think it would, especially having regard to the fact that a good deal of the work connected with forestry would be done in the autumn and in the early part of the year, January and February, when very often there is want of employment for men living in rural districts.

3693. It would have a tendency to keep them on the land?—Yes.

3694. I presume your experience is that there is a great emigration from the country into the towns in that part of North Wales with which you are acquainted, as well as in other parts of the country?—It is perfectly lamentable to see the number of dilapidated, dismantled, and discarded cottages on the hillsides about North Wales, and indeed over a considerable part of Lancashire. On this very Rivington watershed, in Lancashire, of which I have spoken there are numbers of abandoned houses which were formerly occupied by the peasantry, and to a large extent by people who carried on private weaving industries. Those industries have now been put an end to, and the weaving is done in large factories, and the people have no longer any home occupation.

3695. I think, so far as the catchment area is concerned, you prefer people's room to their company: at the same time below the catchment area it would be possible to so arrange matters that the village industries could be carried on without any interference with the purity of the water?—That would be an essential condition—anything done in the way of industries or involving human habitation should be done below the watershed.

3696. Vyrnwy is situated, is it not, between Aberystwyth and Bangor?—Yes.

Mr. J. Parry.

7 May 1902.

3697. Therefore if it were possible to arrange for classes, either at the University Colleges at Aberystwyth or at Bangor, Vyrnwy would equally benefit?—Yes, and I think the scholars would benefit by the experience they would acquire at Vyrnwy.

3698 Up to what height have trees been planted at Vyrnwy?—About 1,200 feet.

3699. Is that your limit?—No, I do not say it is; it depends so much upon the depth of soil and a suitable exposure.

3700. Given a suitable exposure and a proper depth of soil, do you think it would be possible to carry the plantations much higher?—There is no limit if you have those conditions.

3701. With regard to the effect of the planting of trees upon the rainfall and water supply as well as upon the standard of purity, do you think that it helps to guide the rainfall and increase the water supply?—On that point there is considerable misconception. I think the only benefit derived in the way of increasing the flow of water is the diminution in the amount of absorption, not that it accelerates the rainfall but that it diminishes the amount of absorption and evaporation.

3702. In speaking of the cost of cartage, which is very high in that part of the country, do you think it possible that the developments and improvements in steam traction in the future may make it possible to reduce the cost of cartage?—It would be very difficult to arrange a system of steam traction with such very steep gradients, but I did hope for considerable assistance from the Light Railways Act, and I am sorry to say that my expectations have been very much disappointed so far.

3703. Are the railway rates high?—I was not referring to the high railway rates so much as to the fact that advantage has not been taken to the extent I thought it would be of the powers of the Light Railways Act.

3704. Do you consider the existing railway rates high if you do get your timber to the railway?—They are, unquestionably.

3705. I presume that you have absolute control of the game, and that therefore that does not trouble you very much—you are not troubled by the depredations of rabbits?—I have been very seriously troubled, and it is a constant source of difficulty and trouble.

3706. Although you have absolute control over the land, you find it difficult to exterminate the game?—Yes, and I find that the plantations rather tend to increase the difficulties, because the rabbits find shelter in the plantations, and they have to be destroyed.

3707. Have you carried out fencing to any great extent?—We have over 27 miles of fencing around the plantations. In recent work I have not only put up good fences, but also have taken care to put up strong wire netting to protect the trees from rabbits for a sufficient length of time to enable them to get strong and sturdy.

3708. Has that been effective?—Yes.

3709. What would be the value of the land you have planted simply as grazing land—I do not mean necessarily the amount that was paid for it, but the actual letting value as grazing land per acre?—From 1s. to 1s. 3d. an acre.

3710. From the experience you have already had of the Vyrnwy catchment area, do you think other towns would do well to follow your example in that respect and to plant the catchment area?—Undoubtedly, and greatly to extend it.

3711. (*Dr. Schlich.*) Do I understand you correctly to say that out of the total area at Vyrnwy some 14,600 acres are available for planting?—It depends upon the elevation to which you carry out the scheme of planting. If you take it up to 1,500 feet I should say there are 7,000 to 10,000 acres available.

3712. You said you had some difficulty about transport; even if you worked up the material locally, still there is a considerable amount of transport to be done. When the area is in full bearing you would have to transport 12,000 tons per annum?—Yes.

3713. Surely it would be worth while to make special arrangements for that transport by having your own local railway, or something of that kind, when the areas have come into full bearing?—We have not yet reached that stage, and it is so remote that I cannot form any estimate. What I had in my mind was that in these days of small things and beginnings what is perfectly feasible is to arrange for local developments and local industries rather than to attempt very big schemes which involve railways and special arrangements for transport. Ideally those schemes may be very desirable, but I think in practice it is better to adhere to smaller schemes and to operations that are more immediately practicable.

3714. That is quite true. We have had evidence with regard to this question of transport brought before us. These were all cases where small quantities were in question. In a case like this you might plant up some 9,000 or 10,000 acres, and ultimately you would have 600,000 or 700,000 cubic feet of timber to cut annually; in that case it would be possible to make special arrangements for the transport?—Undoubtedly. As the areas planted increased all those difficulties would diminish.

3715. (*Colonel Bailey.*) With regard to the question of the purity of the water, on one occasion I urged a corporation to plant the catchment area of their water supply, and the answer I received was that they did not feel inclined to do so, first of all because they would lose certain grazing revenue; and, secondly, even supposing they were compensated for that, the fact of planting trees on the catchment area would make the water impure, because it would be contaminated by passing through decayed vegetation. You do not believe that?—That is absolute ignorance.

3716. Is it not the case that the water from a wooded area reaches the reservoirs rather by percolation than by rushing over the surface, and thus becomes filtered in the soil?—In both ways.

3717. A large proportion of it, by being held up by the trees, is prevented from rushing immediately down, and thus gradually finds its way into the soil?—There is no difficulty in a properly managed forest in getting rid of all those objectionable features.

3718. Have you ever proved by analysis that water coming from wooded areas is free from contamination?—I have not thought it necessary to obtain special analyses, but I could do so.

3719. Has not the wood on the catchment area another effect in preventing waste by sudden floods? If there is a heavy shower of rain the water runs down at once and overflows your dam, and perhaps damages your works; but if the area is wooded, is not the flow more even and distributed over a greater length of time?—I have not dealt with sufficiently large areas of plantation to prove that.

3720. Are you aware that very careful experiments have been made on that point, and that it has been proved that the evaporation from a wooded area is very considerably less than from a bare area?—Yes, I have heard repeatedly during the last 30 or 40 years opinions expressed by men who ought to be experts in the matter that wooded areas do contribute very much more largely than areas that are not wooded to the amount of water impounded in the reservoirs from a given rainfall; but I think it is not due to the fact of any attraction on the part of forests, but simply to the diminished amount of absorption and evaporation.

3721. You are aware, as I mentioned before, that very elaborate experiments conducted over a long series of years have been made in Germany to prove these facts?—Yes.

3722. (*Dr. Somerville.*) Do you think there will be less pollution in the sense of muddy water in the case of a reservoir whose catchment area is provided with trees than in the case of a bare hillside?—The serious pollution we have to guard and provide against is from the excremental discharges of human beings. That is almost the only source of danger we have very strictly to guard against, because of the risk of conveying disease.

3723. But the cleaner the water is when it enters the reservoir so much the less expense for mechanical filtration?—Clearly so. On that point I may add that it is now the practice in all well-managed works to filter the water from the watershed, however pure it may be, through sand.

3724. Then you are also troubled no doubt in the case of reservoirs, especially when the water has fallen some distance below the high-water mark, with the wind blowing the water up on the muddy banks and becoming polluted?—I have not had very much trouble of that kind, because I stone or shingle the slopes of

Mr. J. Parry.

7 May 1902.

the reservoir down to a point upon which the wave action usually occurs. It does arise occasionally.

3725. Do you contemplate ultimately clearing the whole of the sheep off the catchment area at Vyrnwy?—No.

3726. You do not think that the droppings of the sheep, getting washed as they do into streams and carried into the lake, are of any consequence?—It is a matter of minor importance. I should prefer to have a grouse moor, and naturally an entire absence of animal life.

3727. Do I understand you correctly when you state that you have put out something like 160,000 trees into 400 odd acres of wood during the last five years?—Yes.

3728. If my calculations serve me correctly, that only represents about 400 trees per acre?—I must explain that that is only in a limited number of plantations. If you refer to the statement handed in you will find that the plantations where those trees have been planted are all fully described, and if you look at the map which I put in you will be able to get the corresponding areas of the plantations where the trees have been placed. I should also explain that the bulk of the work during the last five years—not the whole of it—has been the filling up of plantations which were imperfectly and inadequately planted before; that is to say, the trees were too far apart, and afforded no shelter whatever, consequently the trees became inferior and failed.

3729. (*Chairman.*) One of the things you desire and think necessary is the establishment of some centre of information where people could obtain expert advice on forestry?—I think it very important that there should be some better means of giving information to the country on these subjects.

3730. May I ask what you pay your forester?—30*s.* a week and a cottage.

3731. You think evaporation would be minimised if the gathering grounds and the lakes were well surrounded by woods?—I do not attach much importance to that; I merely mentioned it incidentally. I do not think it is of sufficient importance to dwell upon.

3732. In Dr. Schlich's first volume of his Manual on Forestry, he shows by statistics which have been collected in Bavaria and Prussia that there is a very considerable saving in the quantity of water evaporated from a forest as compared with a free surface?—I have not myself made any calculations and observations of that kind. I propose to send to the Committee more accurate figures with regard to the number of acres available for planting on watersheds than those I have given. It would be very useful, I think, if the Government would ask for a return through the Local Government Board of all the watershed areas in the country. There is no such return in existence now, and it is exceedingly difficult to collect information from private sources.

Mr. M. F. ROBERTS, called; and Examined.

Mr. M. F. Roberts.

3733. (*Chairman.*) You are a member of the Institution of Civil Engineers, and are Assistant Engineer-in-Chief to the Post Office?—Yes.

3734. The Committee have to thank you for your most admirable statement (*Appendix XVIII.*), which gives us such full information. We have had evidence that British oak is more durable than foreign oak, and I think your tests support that view?—I have very great difficulty in speaking as to the durability, because the oak cross arms used on telegraph poles get mixed, and it is very difficult, after a number of years, to say whether a particular piece of oak is English or foreign. The tests I have made proved the superiority of English oak as regards its strength when subjected to a torsional strain and splitting strain.

3735. I believe you find it is otherwise with the fir. You find that the coniferous timber which you import from the Baltic is far more durable and grown far cleaner than the home timber?—Yes. That is partly due to the fact that the timber which comes from Norway and Sweden is specially selected for telegraph-poles. There is a good deal of rough Norwegian and Swedish timber imported for other purposes, and it is a little unfortunate that the growers of native timber do not apparently sufficiently understand the business of selecting one class of timber from the other for different purposes.

3736. It may be, of course, that they have none to select quite as good?—I do not think that is always the case, because a certain proportion of the different lots of timber we have had for telegraph-poles has been very good, or fairly good. It has not the strength that Norwegian timber has, but it is very good, and much of it has been useful. The great difficulty is that we cannot get long poles.

3737. The fact that you can get some clean-grown poles, and the knowledge that the Norwegian poles are grown very dense, might lead one to suppose that under similar conditions as good poles might be produced in this country as in Norway?—The conditions are not quite similar. The climate and the soil, I think, are the two features that enter into the matter.

3738. I observe that one explanation of the lack of substance and strength in the Scotch timber that you have had is that it is grown too openly, and puts on the wood too quickly?—That is stated to be the case.

3739. I presume these tests may be taken as thoroughly reliable?—They are absolutely reliable. They have not been made to prove either the one case or the other.

3740. Certainly nothing could appear better on paper. With regard to the creosoting of larch, you say in your statement that in any case larch will not take creosote. I do not know whether that is quite the case. I imagine that creosote can be injected; but even supposing it could be injected, it would be too expensive as compared with the other classes of timbers, would it not?—Not in all cases; because when long larch timber can be obtained in an inland district where it is required, very heavy carriage charges are avoided, and consequently larch, although it would fetch a high price, might be the cheaper. We have used larch to a limited extent where it can be obtained, but we have always failed in efficiently creosoting it. Whereas red fir will easily take 10lbs. of creosote per cubic foot, or 14lbs. or 15lbs. if it were necessary to inject so large a quantity, it is practically impossible in well-grown larch timber to inject more than 3lbs. or 4lbs.

3741. Have you estimated the life of an uncreosoted or partially creosoted larch post, as compared with a fir post properly creosoted?—It is a little difficult, because we have no exact information as to the life of a creosoted pole. Creosoting was introduced in 1868, and we may still have some of those early creosoted poles, but we have not many. Usually a pole does not decay; it has to be removed for a heavier line. Poles that have been removed quite recently, and which were creosoted so long ago as 1870, were in fairly good condition.

3742. Are you substituting iron rods for posts for telegraph wires?—Only in towns, where the local authorities insist on having ornamental iron poles, not in any other case.

3743. (*Dr. Somerville.*) Do you use only Norwegian red pine for telegraph-poles?—We use not only Norwegian, but Swedish and Finnish, if we can get them, and also pitch-pine for the square terminal poles.

3744. You do not use Baltic white wood at all?—No; it will not take creosote.

3745. Do you limit the countries of supply to those that adjoin the Baltic more or less, or would it be competent for a firm to tender for a supply of wood from some North German district?—We have never received in this country any satisfactory timber from North Germany. If anybody offered us North German timber we should certainly consider the offer; but timber merchants in England who deal with foreign timber tell us that suitable timber is not obtainable in North Germany. The Riga timber, which is used for sleepers, is an altogether different class of timber. I know that is not in North Germany, but perhaps you are speaking of that district?

3746. Can you tell us in what respect more particularly it does differ from the Finnish or Norwegian or Swedish timber?—It does not grow so straight, and it has less taper. It is a rather curious thing that Russian timber differs materially from Swedish and Norwegian in that it grows very much more parallel, and although parallel timber is valuable for cutting up into deals and battens, it is not so suitable for telegraph poles.

3747. You like a taper on telegraph-poles?—Yes, we

Mr. M. F. Roberts.

7 May 1902.

require the strength at the butt end. Tapering poles are less expensive to creosote and handle, and more sightly.

3748. I think in some of these tests and trials you made of Scotch fir, it was found the Scotch fir was very much heavier than the foreign fir of equal dimensions. Is that so?—I think that was due to two reasons: First of all, that that timber when first offered to us had not been seasoned to the same extent as the Norwegian timber was when it reaches this country; and, secondly, pieces which our inspector called very ugly sticks were sent. There was no taper; they were unnecessarily large at the top. In fact, the measurement showed that that was the case. The specific gravity of Scotch fir is not greater than the specific gravity of Norwegian fir.

3749. I believe you said there are poles actually in use at the present time which were placed in position before 1870?—We should have a difficulty in finding them; but from time to time a pole is brought under our notice that has been standing since that time. We make inquiries respecting it, and we find it to be in good condition. As I have explained, long before a pole reaches that age the line has as a rule to be increased in size, and a larger pole has to be put up.

3750. Is it a fair question to ask you what becomes of the poles that you take up, whether from being too light or having decayed at the base?—If the pole were decayed at the base we should consider it quite useless, and sell it for firewood, but if it is recovered in good condition we should try to use it on the heavier lines as a strut, that is for strengthening the new pole line.

3751. (*Colonel Bailey.*) You mentioned that home-grown oak was, as a rule, more durable than imported oak, did not you?—No; I am not proving durability, I am proving strength.

3752. The oak is obtained from all sorts of sources, is it not?—Yes; in the tables I give the source of supply.

3753. You apply that generally to all the oak you get, or the majority of the oak that you get?—To the majority, to English timber as a class.

3754. Do you know whether the English oak, as a rule, is quick-grown or slow-grown as compared with the foreign oak?—I should say it took a very much longer time to grow.

3755. You would gauge the quickness of the growth by the width of the rings?—Not only that; but I believe as a rule quickly-grown oak is very much straighter than the oak which suits telegraph arms. Coppice oak is very much quicker grown than harder oaks which answer for telegraph arms.

3756. Were the pieces that you found less strong chiefly clean pieces or rough pieces?—Chiefly clean pieces.

3757. Does the Department find it as easy as formerly to get supplies of timber for telegraph poles?—No, the difficulty is increasing every year with telegraph poles.

3758. It is much more difficult to get the necessary supply of telegraph poles now than it was a certain number of years ago?—The difficulty is so great that I have been sent abroad by the Post Office to endeavour to open up fresh sources of supply.

3759. Have your inspectors reported to you the circumstances that have led to that condition?—We have had the information from the contractors (and I think it is correct) that the longer and more suitable poles have gradually been cut out of the forests, and that people have to go to a greater distance from the coast to get the timber they require.

3760. You do not buy any important part of your supply in this country, do you?—We invite tenders for poles, and we allow any timber merchants to quote for the timber we require.

3761. But, as a matter of fact, you buy a very small proportion of the timber you require in this country?—I think I may say that is so.

3762. Is that because you cannot get it, or because it is not of good quality?—It is for two reasons. First of all, with regard to the foreign timber, the foreign timber merchants have formed a ring, and they will not quote to any English timber merchant who wishes to supply the Government according to the Government specification.

3763. I am referring to home-grown timber, bought from English merchants. A very small proportion of the wood you use is home-grown, is it not?—Practically none of it is home-grown.

3764. What is the reason of that?—We cannot get quotations. People are not prepared to tender. In the summary of evidence which I have prepared I mention one case in which we asked eight firms to tender.

3765. What was the tender for?—To supply a small number of poles, with a view of seeing whether they could supply suitable timber for a larger contract.

3766. Would that mean a contract for a continuous supply every year?—No, we make the contracts from year to year in every case.

3767. In regard to the relative durability of the trees you have mentioned, oak, larch, and Scotch pine, you say they are all creosoted before you use them?—We do not use oak for telegraph poles at all. We use oak for the cross-arms on the telegraph poles.

3768. Do you creosote them?—No, it is not necessary.

3769. Do you do the creosoting yourself?—No, by contract.

3770. Do you know how it is done?—In cylinders under pressure.

3771. You say that the Scotch pine will take in ten pounds of creosote to the cubic foot, and that the larch cannot be made to take in more than three or four pounds. If you cut a pole across, after injecting 10 pounds of creosote to the cubic foot, do you find it has penetrated entirely?—No; if it is a pole about 10 inches in diameter it would penetrate to about 1½ inches.

3772. As much as that?—Yes, through the sap-wood.

3773. It is all in the sap-wood?—Yes. It is impossible in red fir to get the creosote into the heart-wood.

3774. You cannot get it in very far into the larch?—We have tried experiments with larch poles, subjecting them to a pressure of 150 pounds to the square inch, and the creosote then only penetrated three-eighths of an inch.

3775. Would it go right through the sap-wood?—No, it would not.

3776. You speak in your statement about experiments. You have no regular experiments carried on with a series of marked poles, erected for the purpose of determining their life?—No, it would be a very difficult thing to do, because lines are constantly being altered.

3777. I refer to a line of poles of different kinds put up in some special place where they remain for the purpose of testing their durability. You do not do that?—No.

3778. (*Professor Campbell.*) You referred to the increasing difficulty of obtaining your supplies. Is the cost also increasing?—Very much.

3779. Very rapidly?—Very rapidly.

3780. Perhaps you have put that in your statement?—The Postmaster-General desired me not to give exact prices in my evidence.

3781. But still we may take it that the cost has increased?—Yes, very greatly indeed; and we are unable to get at a reasonable price one-tenth part of the home-grown oak we require.

APPENDICES.

LIST OF APPENDICES.

PAGE.

I. Digest of Report and Evidence of the Select Committee of the House of Commons on Forestry in 1885–7. 141

II. Digest of certain Publications bearing on the Objects of the Inquiry :—

- (i) Forestry in France, by Lieut.-Colonel F. Bailey, R.E. - - - - - - - - 146
- (ii) Forestry in Hungary, by Lieut.-Colonel F. Bailey, R.E. - - - - - - - - 146
- (iii) President's Address, Royal Scottish Arboricultural Society, by Lieut.-Colonel F. Bailey, R.E. 146
- (iv) Establishment of State Model Forests for Scotland, prepared by the Royal Scottish Arboricultural Society. 147
- (v) The Proposed School of Forestry, by Sir D. Brandis, K.C.S.I. - - - - - - 148
- (vi) President's Address, 1891, Royal Scottish Arboricultural Society, by I. Bayley Balfour, F.R.S. 149
- (vii) President's Address, 1892, Royal Scottish Arboricultural Society, by I. Bayley Balfour, F.R.S. 149
- (viii) Forestry in Britain, by I. Bayley Balfour, F.R.S. - - - - - - - - - 149
- (ix) Report on a Visit to the Forests of Scotland, 1896, by Dr. A. Schwappach - - - 150
- (x) British Forestry and its Future Prospects, by J. Nisbet, D.OEC. - - - - - - 151
- (xi) The Outlook of the World's Timber Supply, by Dr. W. Schlich, C.I.E., F.R.S. - - 152
- (xii) Insufficiency of the World's Timber Supply, by M. Mélard - - - - - - 161
- (xiii) The Forestry Exhibition at Paris and Some of its Lessons, by J. S. Gamble, C.I.E., F.R.S. 162

III. Relative Merits of British and Foreign Timber (handed in by Mr. S. Margerison) - - 163

IV. Extract, relating to Timber, from the General Railway Classification of Goods, 1902 (handed in by Mr. S. Margerison). 165

V. Example showing the Outcome of 40 acres of a Mixed Larch and Fir Wood at the end of the 75th Year (handed in by Mr. A. Slater). 167

VI. Particulars of Receipts and Expenditure of the Final Clearance of an 18-acre Plantation, 75 to 80 years' growth (handed in by Mr. W. B. Havelock). 167

VII. Note on Rabbits, Game, Thinning of Woods, &c. (handed in by Mr. W. B. Havelock) - - - 168

VIII. Suggestions for the Improvement of British Forestry (handed in by Mr. A. C. Forbes) - - 169

IX. Particulars of Beech Woods in Bucks; Approximate Values of Timber in 1902; and Sales of Timber on certain Estates, with Acreage and Average Price (handed in by Mr. A. Vernon). 171

X. Suggestions for the Improvement of British Forestry (handed in by Mr. D. W. Drummond) - 174

XI. Profits on Woods, Necessity of Education, Ground Game, &c. (handed in by Mr. A. Pitcaithley) - 175

XII. Rating of Woodlands in Scotland (handed in by Mr. J. Maxwell) - - - - - - - - - 176

XIII. Note on the Board of Agriculture's Powers with reference to Loans for Planting (handed in by Major P. G. Craigie). 177

XIV. Returns of Woods (handed in by Major P. G. Craigie) - - - - - - - - - - - - 178

XV. Memorandum on the Official Practice as regards the Assessment of Death Duties in respect of Timber and Woodlands (handed in by Mr. C. O. Minchin). 179

XVI. Outline Sketch of Forestry Course (handed in by Professor H. Marshall Ward) - - - - - 186

XVII. Statement showing the Number of Trees planted on Corporation Lands around Lake Vyrnwy, 1896–1902 (handed in by Mr. J. Parry). 187

PAGE.

XVIII. Post Office Tests of Timber for Telegraph Poles and Cross-arms (handed in by Mr. M. F. Roberts). 187

XIX. Memorandum on Rating of Woodlands, prepared by the Local Government Board - - - - 202

XX. Memorandum by Sir W. T. Thiselton-Dyer, K.C.M.G., F.R.S. - - - - - - - - - - - 204

XXI. Area under Wood of Crown Forests in the United Kingdom (handed in by Mr. E. Stafford Howard, C.B.). 206

XXII. Representation by the University Court of the University of Edinburgh - - - - - 206

XXIII. Instruction in Forestry at Giessen University - - - - - - - - - - - - - 206

XXIV. Programme and Regulations of the Bavarian Lower Schools of Forestry - - - - - - 209

XXV. Information as to the Assistance, by means of Loans, Inspection, Remission of Taxation, &c., that Foreign States give to Planters, and the Encouragement they offer to the Afforestation of Waste Lands, by Dr. A. Schwappach. 210

XXVI. A Review of the Restrictions, in the Public Interest, that States place upon Private Owners of Forests, by Dr. A. Schwappach. 212

XXVII. Area, Receipts, and Expenses, of State Forests in Germany and France - - - - - - 214

XXVIII. The United States Bureau of Forestry - - - - - - - - - - - - - - - 214

XXIX. Instruction in Forestry at Cornell and Yale Universities - - - - - - - - - - 217

APPENDICES.

APPENDIX No. I.

DIGEST of REPORT and EVIDENCE of the SELECT COMMITTEE of the HOUSE of COMMONS on FORESTRY in 1885-7 (H.C. 287, 1885; 202, 1886; 246, 1887).

Note.—In this digest the evidence relating to Ireland, viz., that of Rev. T. F. Flannery, Mr. Andrew Gilchrist, Viscount Powerscourt, and Mr. James Price, all in 1887, has been omitted.

Unskilful Management of British Woods.

Evidence was given that the management of British woodlands was generally unskilful, and that it could be improved (Report, 1887, p. iii., iv.; Barron, 1887, 11-16, 23, 38-9, 84, 110; Boppe, 1885, p. 47; Britton, 1887, 759-60, 781-7, 809-10, 829; Cleghorn, 1885, 302-26, 406-12; Clutton, 1887, 1918; McClellan, 1887, 400-7; Macgregor, 1887, 875-81, 1054-9; Mackenzie, 1886, 505-20. 523-8; Michael, 1885, 269-71; Pearson, 1885, 506, 510-12, 519; Powell, 1887, 2101, 2178-80; Rogers, 1886, 453; Schlich, 1886, 333-8; Thomson, 1887, 1259-60). This condition is, however, due to a great extent to the fact that the woodlands are not always planted or managed for revenue, but often for game or ornament (Boppe, 1885, p. 47-8; Lascelles, 1887, p. 135). And several witnesses stated that there are some well managed woods and good foresters (Boppe, 1885, p. 47; Cleghorn, 1885, 406-12; Clutton, 1887, 1918; Pearson, 1886, 53-6, 136-48; Wrightson, 1887, 323-7). The forests in Scotland appear to be, on the whole, rather better than in England (McCorquodale, 1887, 1342-7; Schlich, 1886, 333-8). Britton considers that there has been deterioration in management (1887, 821); and Schlich, that the planting in Scotland is excellent, but that there has been subsequent mismanagement (1886, 333-8).

Hedgerow Timber.

Much hedgerow timber is spoilt by nails (Britton, 1887, 822-3).

Crown Woodlands.

Public forests are well managed on the whole (Pearson, 1885, 559-61), but the New Forest is degrading, some 40,000 acres having been abandoned, as legislation does not admit of felling or planting, in order to save 14,000 (Report, 1887, p. iv., v.; Boppe, 1885, p. 49; Lascelles, 1887, 843, p. 137-8; Pearson, 1885 476, 560). These 14,000 acres will yield a regular revenue in time, while the future prospects of the Forest of Dean are also good (Boppe, 1885, p. 50).

Climate.

Deforestation affects the climate injuriously (Report, 1887, p. iv.; Brown, 1886, 184, 240; Dyer, 1885, 601-2, 610-15, 627-8), and also causes springs to dry up (Michael, 1885, 228-32, 242, 272-6; Thomson, 1887, 1229-31). In this connection, evidence was given that the area under forests in Great Britain was smaller than theory indicates as the proper proportion for the best conditions of the rest of the country (Cleghorn, 1885, 327-8, 367-80).

Grazing.

Deciduous forests improve the grazing, as grass replaces heather (Boppe, 1885, p. 47-8; Cleghorn, 1885, 418-21, 425; Macgregor, 1887, 886, 903-5, 1103-4; Pearson, 1886, 141).

Industries.

There would be considerable social and economic advantages from planting waste lands, especially in poorer districts, as the increase of woodlands would give much employment (Report, 1887, p. iv.; Cleghorn, 1885, 381-6, 394-401; Macgregor, 1887, 1,121; Michael, 1885, 235-41, 277).

Planting and Management of Woodlands.

A certain amount of miscellaneous evidence was given as to planting and the way in which forests ought to be managed. Thus, the only sound economic principle in forestry is a "constant annual revenue and a constant improvement in production." Owners should draw up a working plan and stick to it (Boppe, 1885, p. 48). Timber should be cut when most profitable (Schlich, 1886, 329-32, 343-6, 367-9), and this most profitable time is prior to maturity (Pearson, 1885, 522, 556-8). Barron considers that trees should be first grown in nurseries, and planted when 4-5ft. high (1887, 53, 175-7); he prefers planting them wide apart—about 12ft.—to thinning (1887, 185-7, 193, 199-207); and holds that trees should be pruned (1887, 189-98), and the shoots of pines stopped (1887, 28-9, 38-9). There is a tendency to decay when trees are frequently planted in the same soil (Thomson, 1887, 1161-5, 1294-6). Referring more particularly to oaks, Boppe points out that broad-leaved trees take a longer time to establish than conifers; oaks furnish the soil with much less vegetable manure, and with oaks there is also less spontaneous ground vegetation (1885, p. 50). Oaks usually succeed only at the second generation (Boppe, 1885, p. 50). Oaks should be transplanted (Campbell, 1887, 745-9).

Appendix I.

Cost of Planting.

The following statements as to cost of planting were made:—An estimate for 20 acres of larch came to £84, viz., fencing, £41; cost of plants, £25; planting, £8; and rent, at 10s. per acre, £10 (McCorquodale, 1887, 1379-81, p. 127). Fencing costs about £2 per acre on large areas (Macgregor, 1887, 1093, 1102). 2,232 Scotch acres on the Duke of Athole's estate were planted in 1825-6 with larch and a little spruce at a cost of £4,147, or 37s. 2d. per Scotch acre, viz., value of ground, 25 years' purchase at 9d. per acre, 18s. 9d.; fencing (6¼ miles), 4s. 9d.; roads (5 miles), 3s. 5d.; plants (4,198,300), 6s. 5d.; planting, 2s. 10d.; contingencies, 1s. (Macgregor, 1887, p. 128). Another 2,932 Scotch acres on the same estate, planted in 1815-1818, came to 50s. per acre, viz., value of ground, 25 years' purchase at 9d. per acre, 18s. 9d.; fencing, 11½ miles, 6s. 2d.; roads, drives, and bridges, 8s.; 6,377,100 plants, 7s. 3d.; planting, 3s. 3d.; miscellaneous and subsequent expenditure, 6s. 7d. (Macgregor, 1887, p. 128). A plantation of 900 acres on the Countess of Seafield's estate was fenced, planted with Scots fir, larch, and some other trees, at a cost, including cartage and labour, of £1,300, or about 30s. per acre (Thomson, 1887, 1154, 1212, 1297-1304)

Suitable Varieties of Trees.

As to the growth of individual species in this country, Boppe points out that Scots fir and larch are very successful at high altitudes (1885, p. 46-7), and recommends beech in Scotland, in many cases substituted for, or mixed with, birch (1885, p. 47). Scots fir does better in Scotland than in England (McCorquodale, 1887, 1400-06). The growth of larch is recommended (Boppe, 1885, p. 46-7; Powell, 1887, 2059-60, 2074-5).

Larch Disease.

The prospects of larch plantations are considerably affected by the larch disease. This tree suffers much from the disease in Britain, but not in the Alps, and suggested remedies are rotation of crop, use of seed from the Alps, or self-reproduction (Pearson, 1886, 66-74, 85-105, 113-25); some larch fails from mistakes in planting (Pearson, 1886, 131-5). Macgregor would not plant larch at present on account of the disease (1887, 944-5, 1000-2, 1068-71), which has increased (1887, 1087-92, 1107-8). Powell thinks that the disease is due to an insect, and is likely to decrease (1887, 2059, 2076-80, 2120-8, 2152-8).

Other trees recommended are Corsican pine (Barron, 1887, 45-50), Austrian pine for shelter (Barron, 1887, 47, 199-201), Douglas pine (Barron, 1887, 45-50, 54-9, 163, 177-82; McCorquodale, 1887, 1367-70, 1374-7, 1393-5; Powell, 1887, 2059-60, 2142-6, 2173-6), *Pinus montana* on peat mosses (Boppe, 1885, p. 47), silver fir (McCorquodale, 1887, 1398-1403). A plantation of eight acres under Douglas pine had just been thinned on Lord Mansfield's estate at Scone, and the thinnings, 620 trees, not then sold, were expected to fetch 4s. to 6s. per 100 feet (McCorquodale, 1887, 1367-70, 1374-7). Hooker, on the contrary, cannot suggest any trees which it would be profitable to grow in this country, because change of climate, particularly more rapid growth, may completely alter the timber and render it of less value, as in Corsican pine, cedar, and Douglas pine (1887, 2220-9). Climate may also encourage disease (Hooker, 1887, 2226-9; Pearson, 1886, 90).

Injury by Game and other Animals.

Animals are shut in the forests instead of out, with the result that all undergrowth is grazed down, there is no regeneration, and when trees are cut down or uprooted by gales the forest disappears entirely (Boppe, 1885, p. 47). Cattle should be kept out, they injure mature trees by rubbing against them (Powell, 1887,

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2136); sheep are the "arch enemy" of forests (Boppe, 1885, p. 45). Game is injurious, and plantations suffer much from it (McCorquodale, 1887, 1371-3); more particularly from rabbits (Elliot, 1887, 505-6, 524-6; Macgregor, 1887, 980-2; Thomson, 1887, 1330-1), capercailzie, hares and grouse (Macgregor, 1887, 980-2), and also squirrels (Thomson, 1887, 1202).

Taxation.

The only mention of death duties is that they are "extremely unpleasant" (Bathurst, 1887, 582-5).

Rates.

Rates are a great discouragement to planting (Clutton, 1887, 1932, 1973-5; Powell, 1887, 2056, 2097-9, 2108-16, 2137-9). In America all land planted is exempted from taxation, and a bounty is offered for planting (Powell, 1887, 2056).

Fall in Value of Timber.

There has been a general fall in the value of timber (Bathurst, 1887, 559-64), and prices have gone down by a third in the past ten or fifteen years (Thomson, 1887, 1201). This fall is mainly due to foreign competition (Britton, 1887, 761-80, 788-809, 812-14; Dundas, 1887, 1415, 1423; McCorquodale, 1887; 1362; Macgregor, 1887, 1060-8). Britton refers more especially to Norwegian timber, and states that fully nine-tenths of the timber used in the mining districts of Staffordshire now comes from Norway (1887, 765). Foreign competition is also one reason why the Forest of Dean does not pay (Campbell, 1887, 658-63, 677-82). The fall in value is also attributed in part to the substitution of metal for wood in many industries (Dundas, 1887, 1415, 1466).

Profits

As to the present profitableness of woods, it is stated that they do not pay, and there is no market for thinnings (Clutton, 1933-6, 2025-8), and Dundas sells his own wood (thinnings and pit props) for what it will fetch, preferably to using it on his own estate (1887, 1417-18, 1450-2). Clutton states that the Crown woods managed by him have certainly not been a loss (1887, 1966-72), and Macgregor, that his woods have been successful commercially, though less so than formerly (1887, 1077-83). Timber will yield a good return if well managed (McCorquodale, 1887, 1363-6). Woods on the Strathspey estate should yield 10s. per acre per annum (Thomson, 1887, 1213-15). An estimate of the value of 20 acres of larch indicated a total profit after 80 years of £3,200, after allowing for cost of planting and interest, etc. [but no allowance for rates and taxes, and only one year's rental] (McCorquodale, 1887, 1378-88, p. 127).

Foreign Competition.

Circumstances favouring imports are, the advantage possessed by foreign timber owing to cheapness of labour in Europe, and regularity of supply (Schlich, 1886, 320-1, 345-7); while foreign timber is also favoured by railway rates (Britton, 1887, 769-80, 793-800; Powell, 1887, 2057, 2092-6, 2151). Thomson finds no difficulty in getting timber to market (1887, 1200, 1227).

Railway Rates.

Quality of Home and Foreign Timber

As regards the comparative merits of home and foreign timber, the evidence is somewhat conflicting. Macgregor considers that home-grown timber is as good as foreign (1887, 971-9, 992); and Britton states that the latter is used for different purposes, but is not better than English (1887, 815-20, 825). On the other hand, Schlich states that in some cases foreign timber is of better quality than British (1886, 320-1, 345-7); while Dundas, who owns woodlands and a colliery, always uses foreign timber on his estate in preference to his own, because it is cheaper (1887, 1415), and further states that mine managers prefer foreign timber, which is cleaner and straighter (1887, 1415-19).

Use of Timber.

As to the uses for English timber there is little evidence. Beech, much used for firewood abroad, is difficult to sell in England (Pearson, 1886, 137-8). Bathurst's beech is used chiefly for making bobbins, chair-seats, and walking sticks (1887, 590). Dundas sells his thinnings to small merchants who principally use it for repairs (1887, 1417-18); he also sells wood for pit props (1887, 1450-2). It is pointed out that the small wood, for which there is no demand here is much used abroad for making toys and other small objects (Dyer, 1885, 619-24).

ales.

Foreign competition is more important, as a factor in low prices, than gales (Macgregor, 1887, 1060-8, 1136-9). Timber which has been blown down, however, does not usually fetch so good a price as properly matured wood (Pearson, 1885, 523-8). Gales occasionally cause great loss by glutting the market (Macgregor, 1887, 1060-8, 1136-9; Schlich, 1886, 306-8, 389, 410-11, 426-30); damage from this cause can, however, be to a great extent prevented by shelter belts (Schlich, 1886, 410-11, 426-30).

Imports.

The imports of timber and wood products are very large (Cleghorn, 1885, 341-5; Michael, 1885, 261-4; Schlich, 1886, 251) and a considerable proportion of these imports could be profitably grown in this country (Barron, 1887, 70-5, 129-47, 155-60; Cleghorn, 1885, 341-5, 358-66; Schlich, 1886, 252-3 265-70, 301-5, 375-81; *see also* under Waste Lands, *infra*). In this connection it may be noted that the home production of timber has been estimated at £3,000,000 per annum (Schlich, 1886, 323).

Future Prospects.

Many witnesses were of opinion that prices in the future would rise, although not immediately (Powell, 1887, 2052), or rapidly (Schlich, 1886, 255-62), on account of the present rapid deforestation abroad and the consequent future diminution in the foreign and colonial supplies (Brown, 1886, 224-6; Cleghorn, 1885, 346-7; Pearson, 1885, 514-16; Powell, 1887, 2051-9, 2070-3, 2129-31, 2140-1, 2147-51; Schlich, 1886, 251-62, 298-300, 319-21, 339-42, 404-6; Thomson, 1887, 1222-4, 1256-8). Only from Germany is there likely to be any increase in exports, owing to the general good management of the forests in that country (Schlich, 1886, 404-6).

Other witnesses, generally recognising the probable diminution of supplies from abroad, and a consequent rise in price, also expressed favourable opinions as to the prospects of growing timber in this country. Forests will play an important part in the immediate future (Boppe, 1885, p. 50); it will pay in the long run to put land under timber (Rogers, 1886, 454-7); considerable areas could also be planted near navigable rivers (Cleghorn, 1885, 359-66, 402, 417, 426-8, 448-51); with judicious management timber will probably pay in future (Clutton 1887, 1973, 1988-9); Scots fir will be profitable in the future (Macgregor, 1887, 1003-6, 1013-15).

State Aid.

Some witnesses stated that there was no reason why forestry should receive State aid any more than agriculture (Bathurst, 1887, 552-4, 569-73; Campbell, 1887, 660, 664-8; Dundas, 1887, 1424-5). State loans would be of no advantage if interest were charged; no repayment ought to be required until the crop was ripe (Campbell, 1887, 665-8). On the other hand, it was pointed out that the increase of timber was a question of national importance, and ought to be aided by the State (Clutton, 1887, 1959-66, 2024). Very few owners can afford to plant because of the long deferment before any return comes in (Clutton, 1887, 1985; Macgregor, 1887, 1126-35, 1140; Rogers, 1886, 454-7), and they prefer the more immediate income which they can derive from agriculture or game (Macgregor, 1887, 1110, 1141-3); only the Government can afford to wait for the profits (Rogers, 1886, 454-7). The State should give a subsidy for growing trees, as foreign competition will diminish (Thomson, 1887, 1222-4), and the Government might also plant waste lands (Macgregor, 1887, 1033-44; Rogers, 1886, 454-7).

Waste Lands

Our climate is very suitable for forests, as evidenced by existing woodlands and the fine size of individual trees (Boppe, 1885, p. 45-6, 48). Large areas of waste lands might profitably be planted (Report, 1887, p. iii.; Macgregor, 1887, 885, 969-70, 1028-44 1121-25; Powell, 1887, 2074-5, 2117-8; Schlich, 1886, 263-5, 375-9; Thomson, 1887, 1215, 1225-6, 1232-4, 1249-55, 1325). Boppe (1885, p. 46) estimates that there are 5,000,000 acres in the Highlands, and Schlich (1886, 265-70) that there are probably 20,000 square miles in the United Kingdom which might be profitably planted. Two witnesses oppose this view, Barron saying that woods should not be planted on inferior soil (1887, 27, 42-4, 127-8, 164-72); while Dundas holds that land of less than 3s. rental per acre is too poor for planting, and if worth more can be better employed in agriculture (1887, 1421-3). Barron states also that large tracts of land could be profitably cultivated which now grow rubbish (1887, 60-62, 72, 95-104, 173-4), but by this he appears to mean that large areas of woodlands now actually mismanaged could be rendered profitable, not that waste lands should be planted. As regards the upper limit of value of waste lands, Thomson considers that land should not be planted if it is worth 7s. 6d. or 10s. per annum, and then only in tracts of 300 acres or more (1887, 1215, 1225-6); Powell if it is worth 5s. to 10s. (1887, 2074-5, 2117-8); Macgregor if it is worth 7s. 6d. (1887, 1007-9); and Schlich, if the land is required for agriculture (1886, 263-5, 375-9). Macgregor stated that the average rental of the 20,000 acres under timber on the Duke of Athole's estate would be 2s. per acre "overhead" (1887, 1105-6).

Forestry v. Grazing or Game.

Many owners prefer the immediate rentals from grazing or game (Macgregor, 1887, 1110, 1141-3), while even waste lands may be more profitable as game preserves (Schlich, 1886, 328, 390-2).

Need of Education.

Proper methods of conservation and education of foresters have been followed by beneficial effects.

Conservancy and training have greatly increased the Indian forest revenue (Michael, 1885, 198-210, 265-7); Pearson, 1885, 468-72; Pedder, 1885, 1-12, 43-5, 65, 145, 188-90); while the forests in Germany have been greatly improved, and the production of wood in that country is increasing (Schlich, 1886, 404-6). The difference between skilled and unskilled management of the comparatively small State woodlands in this country would more than repay the cost of a State school (Report, 1887, p. iii.).

The establishment of a forest school and examinations, or, at any rate, of organised instruction, is recognised by all witnesses, but witnesses differed as to the mode in which this object could be secured (Report, 1887, p. iv., v.).

Existing Education—Great Britain

Nearly all foreign countries have schools of forestry (Report, 1887, p. iv.; Brown, 1886, 239), while Great Britain has only Cooper's Hill for the Indian students (Pearson, 1886, 9, 25-6, 159-74; Pedder, 1885, 17-42, 46-54, 170-6, 191-2; Taylor, 1887, 2414-25), with a school for lower grades at Dehra Dun (Pedder, 1885, 36-40, 46-55, 191-2), although the area under forests in the British Empire is greater than that of any other country (Report, 1887, p. iii.; Boppe, 1885, p. 50-1). The instruction given at present in this country, apart from Cooper's Hill, consists of courses at Cirencester and Downton (Elliott, 1887, 472-95, 518-9; McClellan, 1887, 354-6, 363, 396-9, 408); Wrightson, 1887, 225-38, 264-9, 284-5, 288-91, 345-7). Examinations in forestry are also held by the Surveyors' Institution in London, and the Highland and Agricultural Society at Edinburgh, but the number of candidates is in both cases small (Macgregor, 1887, 907-23, 930-2, 951-9; Rogers, 1885, 642-3, 1886, 442-9).

For working foresters and woodreeves the only instruction is the training they obtain under more experienced foresters in large forests, who frequently take pupils (Bathurst, 1887, 557-8, 565-8, 598-605; Campbell, 1887, 629-35, 656-7, 683-8, 711; McCorquodale, 1887, 1348-52, 1355, 1396-7; Thomson, 1887, 1157-60, 1219-22, 1238-43, 1261-7, 1310, 1319-21).

Foreign Schools.

The following evidence concerning the education provided abroad was given:—

France.

The course at Nancy is two years, but kindred subjects are also taught. Candidates for Indian service take a preparatory course of eight months before going into the school (Pearson, 1886, 16-17, 28-33, 159-71). The cost at Nancy is £120 per annum for French students, and £144 for English; the total expense for English students for the two and a-half years being generally reckoned at £500 (Pearson, 1886, 167-70). This is too expensive for foresters (Pearson, 1885, 482-4).

Spain.

The best model on which to base a school in this country would be the school in Spain (Brown, 1886, 202-3; 1887, 2241-2, 2254-66). The Spanish school of forestry is a Government school for forest engineers, the teachers being selected from the superior forest offices, who manage the State woodlands (Brown, 1887, 2241-52, 2269-70, 2276-8). No education is provided for the workmen in the forests; it was tried once, but without success, and it was found better to entrust their education to the trained students who had left the school (Brown, 1887, 2253).

India.
Cooper's Hill.

There are two classes of education for the Indian forest service, viz., higher education at Cooper's Hill, supplemented by a stay at Nancy, for the higher grades, which are mostly filled by Europeans; and elementary forest education at Dehra Dun, chiefly for natives, who fill the lower positions in the Government service (Pedder, 1885, 17-42, 46-64, 170-6, 191-2). Cooper's Hill is an engineering college, but some of the students undergo a special training for the Indian Forest Service. The course is 22 months at Cooper's Hill and four months in English or Continental forests. The students are tested by periodical examinations (Taylor, 1887, p. 139-40). There are two professors of forestry, who give between them about two lectures a day (Taylor, 1887, 2423). The fees at Cooper's Hill just about balance the expenditure (Taylor, 1887, 2450-1); the cost of Dehra Dun is about £4,000 per annum (Pedder, 1885, 53-6).

Character of Instruction Required.

There are, roughly, three classes of persons requiring instruction, divided by Pearson into (1) persons intended for the Indian and Colonial service, (2) land agents and the like, who will earn from £200 to £600 a year, and (3) woodreeves, wood bailiffs, woodmen, and foresters (£80 to £120 a year). (Lascelles, 1887, p. 135; McClellan, 1887, p. 129; Pearson, 1886, 9). This classification is not quite universal, and the committee themselves consider that the principal instruction required is for land agents, foresters, and woodreeves, who might receive instruction with those studying the higher branches for home, Indian, and Colonial service; even for ordinary woodmen, simple and practical instruction would be very useful (Report, 1887, p. iv.). Elliot also includes in Pearson's first-class persons who are intended for positions of responsibility at home, such as Woods and Forests Commissioners (Elliot, 1887, 536).

Higher Education.

As regards the highest class, sufficient education is already provided at Cooper's Hill for the Indian students, but no provision is made for educating others who aspire to similar positions elsewhere. More particularly, evidence was given that applications are frequently received from the Colonies for trained men, and that the Government have always been unable to recommend anyone trained at home. Education is therefore required for such men (Brown, 1886, 181-90, 192, 237-8; Dyer, 1885, 591-2, 597-602, 610-5; Pearson, 1885, 477-9; Schlich, 1886, 279-84, 436-9), while some men might also make a living in this country by acting as technical advisers (Campbell, 1887, 700-1; Pearson, 1885, 573-5).

Education of Land Agents, &c.
School of Forestry.

Coming to Pearson's second-class—land agents and the like—there is great diversity of opinion. The majority of the witnesses favour the establishment of a school of forestry, usually a joint school for this and the lower grade, Boppe stating that a forest school is a matter of primary importance (Report, 1887, p. iv., v.; Barron, 1887, 21-8, 66-7, 79-80, 93, 112-26; Boppe, 1885, p. 50-2; Britton, 1887, 330-5; Brown, 1886, 192; 1887, 2241-2, 2254-66; Cleghorn, 1885, 311-18, 329-40, 403-5, 413-6; Clutton, 1887, 1924-31, 1937-44, 1955, 1994-2001, 2008-13; Dyer, 1885, 603-9; Hooker, 1887, 2185-97, 2201-12; Macgregor, 1887, 924-9, 933, 946-50, 962, 965-8, 1022-3, 1116-20; Mackenzie, 1886, 501-4; Michael, 1885, 249-60; Pearson, 1885, 485-90, 509, 529-36, 544-5, 573-4, 579-87; 1886, 9; Pedder, 1885, 174-6, 195-7; Powell, 1887, 2061-8, 2102-7, 2159-64, 2168; Rogers, 1885, 640-6; 1886, 458-9, 469-70, 477-81, 497-8; Schlich, 1886, 271-8, 313-5, 434-5, 440-1; Thomson, 1887, 1156-60, 1168-71, 1216, 1267-76, 1311-17); while others think that sufficient instruction could be given in connection with existing institutions by means of courses in forestry, which should form a larger portion of the curriculum, combined with practical work and demonstrations (Campbell, 1887, 637-8, 706-10, 731-2, 751-5, p. 134; Ducie, 1887, 442-4; Dundas, 1887, 1435-44, 1453-63; Elliot, 1887, 500-4, 509-10, 536; Lascelles, 1887, 857, 860, p. 136; McClellan, 1887, 367, 413-27, p. 130; McCorquodale, 1887, 1356-61; Wrightson, 1887, 239-46, 276-83, 286, 297, 338, 342-4), and object to a separate school (Bathurst, 1887, 547, 571, 609; Dundas, 1887, 1435, 1445-6; Campbell, 1887, 629-35, 656-7, 683-8, 711; McCorquodale, 1887, 1352-6, 1389, 1396; Wrightson, 1887, 239-46, 276-83, 286, 297, 338, 342-4).

Courses in Forestry.

Courses in addition to School.

Some witnesses considered that there should be, in addition to a school of forestry, professors of forest economy at Cooper's Hill and Edinburgh (Boppe, 1885, p. 51), and that forestry should also be taught in connection with agriculture at Cirencester, Downton, and the Scotch universities (Hooker, 1887, 2185-97, 2201-12).

Lower Education.
School.

As regards the third class of student, again, there were two well-marked views, some holding that foresters and woodreeves should attend the elementary courses (usually at a school of forestry) of the curriculum for intending land agents, etc., who would carry their education on further (Dyer, 1885, 607-8; Hooker, 1887, 2198-200, 2212, 2215-9, 2230-7; Lascelles, 1887, p. 136; Pearson, 1885, 485-90, 509, 529-36, 544-55, 573-4, 579-87; 1886, 9, 14-5, 18-9, 34-6, 60-1, 127-9). In addition, many of the Scotch witnesses noted in the last paragraph but one as approving a school, have apparently considered such a school as being intended for the lower grades (*e.g.*, Macgregor, Thomson). The other view is that woodreeves are best trained in the forest under more experienced men or land agents (Bathurst, 1887, 600-8; Campbell, 1887, 641, 671, 734-7, p. 134; Clutton, 1887, 1941, 1949-54, 2031-3; Dundas, 1887, 1435; Lascelles, 1887, 857-60, p. 136; Wrightson, 1887, 264-9, 284-5, 288-91, 345-7), with the help of a few simple lectures (Rogers, 1886, 486-93; Schlich, 1886, 294-7, 401-3).

Training under older Men.

School Schemes.

Two main ideas for a school were put before the Committee. (1) Pearson's views are that a forest school is required, to reach as low a class as possible, sufficiently economical for wood reeves, while the higher courses of study might be available for land agents (1885, 485-90, 509, 529-36, 544-55, 573-4, 579-87). A complete forest education is not in general wanted in Great Britain, because the salaries paid to foresters are not high enough to make it worth their while (1885, 497, 536, 553). The best instruction for men of university type is about two years, forestry being taken concurrently with other sciences;

such men would afterwards go to India or the Colonies (1885, 498-500, 553-4). For the woodreeves there should be shorter courses of instruction, preferably a total of six weeks to three months, spread over different periods of the year (1885, 489-50, 533-36, 544-55; 1886, 9, 18-9, 34-6, 60-1, 127-9).

(2) The chief alternative school was proposed by Rogers, and two or three land agents, who think that the school should be on very modest lines at first (Powell, 1887, 2061-8; Rogers, 1886, 458-9, 469-70. 477-81, 497-8). Land agents cannot afford to spend two or three years on forestry, and residence would be out of the question (Rogers 1886, 458-9, 469-70, 477-81, 497-8); there should be two courses of three weeks each, with an interval between and excursions in spring and autumn (Rogers, 1886, 459-68, 471, 474, 494-6). Rogers's theoretical grounds are thus similar to those of witnesses recommending the provision of adequate courses at existing agricultural colleges, but he objects to the latter form of providing the instruction (1886, 476), and is supported by Clutton, one reason given being that many land agents do not pass through such colleges (Clutton, 1887, 1928). Brown, on the other hand, thinks that the school should provide a much more extensive education than is suggested by Pearson, and gives a detailed curriculum (1886, 208-10, 241).

Period of Education.

Other statements, besides those already noticed, as to the length of the course for foresters and woodreeves are, that three months would not be enough (McClellan, 1887, p. 130), that they should have six months (Mackenzie, 1886, 522-3), that they should attend for one year, three months being insufficient (Brown, 1886, 214-7, 223, 232, 236), and that two years are required (Macgregor, 1887, 1050-1). In these opinions, however, it is not always clear how much of the time named is to be actual attendance at the courses, and how much to be work in the forest.

Assistance to Foresters to attend courses.

It is recognised that foresters are not sufficiently salaried to attend a school (Dundas, 1887, 1435; McCorquodale, 1887, 1352-6, 1396; Pearson, 1885, 482-4), and the anticipations of failure of a school appear to be due to a feeling that it would not pay (Campbell, 1887, 629-35, 656-7, 683-8, 711; Dundas, 1887, 1435, 1445-6; McCorquodale, 1887, 1352-6, 1389. 1396; Thomson, 1887, 1169-71, 1207). Macgregor accordingly proposes that foresters should attend free (1887, 967-8), and Dundas that they should be helped with bursaries (1887, 1435-44, 1453-63).

School Locality.

More than one centre would be desirable, although one school might be established at first, to secure the best equipment and sufficient students (Report, 1887, p. iv., Powell, 1887, 2159-64). A centre would be required for Scotland (Report, 1887, p. iv.; Barron, 1887, 21; Macgregor, 1887, 924-8; Pearson, 1886, 48-52, 81-4, 130, 151, 156). Three witnesses considered that a single school would be sufficient (Brown, 1886, 199-201, 245; 1887, 2241-2, 2254-66; Campbell, 1887, 669-70; Schlich, 1886, 370-2, 383-8, 412-3). Several witnesses considered Cooper's Hill the most suitable locality, chiefly because, there being already a chair of forestry, it would be cheaper, and it is close to a forest (Report, 1887, p. vi.; Pearson, 1886, 9, 36, 59, 106-12, 152-8; Rogers, 1886, 460-2; Schlich, 1886, 271-8, 313-5, 434-5, 440-1). Dyer thought that it should be near the metropolis (1885, 603-9), Powell in London, ultimately with a branch at Edinburgh (1887, 2061-8, 2102-7, 2159-64, 2168), Brown at Edinburgh (1886, 199-201, 245; 1887, 2241-2, 2254-66), while Schlich qualified his preference for Cooper's Hill by the opinion that, if an entirely new school were to be started, it should be near Perth (1886, 370-2, 383-8, 412-3).

School National versus Private

The school should be a State school (Boppe, 1885, p. 51; Brown, 1886, 204-7; Clutton, 1887, 1928; McCorquodale, 1887, 1390-2; Rogers, 1886, 476); and the Indian students should form a nucleus (Report, 1887, p. iv.; Dyer, 1885, 603-9; Hooker, 1887, 2185-97, 2201-12). Pearson considered that it should be attached to King's or University College, London, but not to Oxford or Cambridge (1885, 488, 501); Brown to the Council on Education (Museum of Science and Art), at Edinburgh, though the Watt College would be cheaper (1886, 204-7, 227-30, 243; 1887, 2257-8, 2265-6). Clutton considered that it should not be attached to any existing body (1887, 1928-31, 1996-7); while McClellan objected to its being attached to Cooper's Hill, or King's or University College (1887, p. 131-3), and Rogers to Cirencester or Downton (1886, 476).

Education of Landowners.

Lascelles emphasised the necessity of owners of land receiving instruction in forestry, and suggested that courses might be given at the higher public schools near forests, such as Eton and Marlborough (Lascelles, 1887, p. 135-6).

Development of existing Institutions.

As regards the practicability of developing existing institutions, evidence was given that Cirencester and Downton could greatly extend the education provided in forestry, so as to meet the needs of higher students, but the provision of education for woodreeves would be a much more difficult matter (Campbell, 1887, 643-6, 650, 738-41; Ducie, 1887, 449-51; Elliot, 1887, 496-500, 516-20; McClellan, 1887, 363-4, 370-5, 383-99, 408-25, 431-3; Wrightson, 1887, 246, 254-5, 271-5, 294-304, 318-22, 329-42). At Cooper's Hill, however, probably only the regular course, as provided for the Indian students, could be taken, and even the elementary lectures of this would be above the heads of woodreeves (Taylor, 1887, 2425-50, 2454-5, 2466-7, 2471-8).

Lower Education—Miscellaneous Suggestions.

The following statements on various points concerning the education of foresters and woodreeves was also made. McClellan (1887, p. 132), and Campbell (1887, p. 134), opposed concurrent education of woodreeves and land agents. Hooker (1887, 2233-7), held that the training of woodreeves on the estate was not sufficient. Wrightson considered that the education of handicraftsmen was not so important as that of the higher class, who administer the estate (1887, 345). Woodreeves, if they had education, could rise to higher positions (Hooker, 1887, 2198-200, 2212, 2235-6; Thomson, 1887, 1204-7, 1219-22, 1267-66), and the labourers performing the labour at the school would learn much (Pearson, 1885, 583-7). Some witnesses thought that the elements of forestry should be taught at the Board Schools (Campbell, 1887, 641, 671, 734-7, p. 134; Macgregor, 1887, 1024-7; Mackenzie, 1886, 501-4; Powell 1887, 2069, 2165-7).

Cost of School or Courses.

As regards the cost of a school, Pearson at first put this at £600 per annum for salaries, viz., two lecturers at £250, and a museum curator at £100 (1885, 495-6). In a revised estimate the following year he puts the annual amount at £1,350, of which £1,150 would be salaries. The expenses of buildings, he considers, need not be great, as the pupils would mostly live outside and pay their own travelling expenses. Against the expenditure there would be set the fees, which he estimates at £1,000, from 50 pupils at £20 a head (1886, 9, 22-4, 42, 57). Rogers, for his more modest school, gives a somewhat similar estimate, viz., £1,200 for lectures and secretarial work, against which would be set the fees at £20 per head, and probable grants in aid from societies (1886, 473-5, 485, 491). Thomson considers the necessary staff to be a professor at £400 to £500, and a practical teacher of forestry at £200 (1887, 1187-90). Dundas thinks the school could not be managed on £600 to £700 a year (1887, 1445-6). McClellan estimates that Cirencester could be developed so as to give complete instruction in forestry at an expense of about £600 a year, while a national school of forestry would probably cost £100,000, with a large annual outlay (1887, 370-1, 423).

Expenses of Students.

Pearson considers that, for his scheme of instruction the cost to foresters would be 10s. or 12s. a week for board and lodging at some country inn, together with fees (£5 to £10) and journeys (1886, 47-8). Landowners might send their foresters to such a place (1886, 35). If courses were provided at Edinburgh and Aberdeen, Dundas thinks that bursaries of £20 to £25 a year would enable a forester who knew his practical work to get additional training at those universities (1887, 1435).

Fees at existing Colleges.

The fees at Cirencester are £135 for in-students, and £75 for out-students (McClellan, 1887, 390), and at Downton about the same (Wrightson, 1887, 313, 338). Residents at Cooper's Hill pay £180 per annum; to non-residents the fees would be about £30 per annum (Taylor, 1887, 2414-25).

Demonstration Forest.

Practically all the witnesses concur that some amount of instruction should be given in a forest. The absolute necessity of a demonstration forest, part leaf and part conifer, is emphasised (Boppe, 1885, p. 51; McClellan, 1887, p. 130; Pearson, 1885, 491-4, 549-51; 1886, 9, 20-1, 43-6, 75-8, 175-7; Schlich, 1886, 289-93, 316-7, 357-9, 417-25), and others also support the projected demonstration forest (McCorquodale, 1887, 1390-2; Macgregor, 1837, 927, 966; Rogers, 1886, 461-3, 482-3; Thomson, 1887, 1180-6, 1277-80, 1315-17).

There is more difference of opinion as to who should control the forest utilised by the students. Some witnesses hold that it should be a State forest (Boppe, 1885, p. 51; McCorquodale, 1887, 1390-2; Pearson, 1885, 537-42; Thomson, 1887, 1277-80), for the reason that change of ownership might cause changes in management (Thomson, 1887, 1277-80), and also because there being no suitable forest in existence the proposed area must be incomplete at first, and can only be perfected in time (Boppe, 1885, p. 51). On the other hand, some witnesses merely state that the students should have access to a forest (Mackenzie, 1886, 520-1), which need not necessarily be connected with the school (Clutton, 1887, 1944-6), or which ought not to be under the control of the Professor of Forestry (McClellan, 1887, p. 131). Brown considers that a demonstration forest is not required at all, but that the pupils should make excursions to forests, and do the practical work by arrangement with foresters (1886, 194-8, 216-7, 233, 242, 244; 1887, 2267-72).

A forest should also be purchased in Scotland (Boppe, 1885, p. 51).

Besides a demonstration forest, it would be desirable to have a nursery near the school (Elliot, 1887, 538-9, McClellan, 1887, p. 133); but a plantation is always incomplete as a field of study (Boppe, 1885, p. 51).

As regards the locality of a demonstration forest, Boppe considers that there is no forest suitable (1885, p. 51), because there are no mature forests in Great Britain (Boppe, 1885, p. 51; Pearson, 1885, 503, 520), although Pearson holds that bad forests are required as well as good for demonstration (1885, 562). Regarding the three large State or Crown forests, the following opinions are given as to their suitability:—

New Forest.

The New Forest is not suitable (Boppe, 1885, p. 48; Lascelles, 1887, 844, 850, 855, p. 137-8); it is suitable to some extent, but there are not enough conifers (Pearson, 1885, 540-2, 562, 588-9); it is better than the Forest of Dean (Schlich, 1886, 420-5).

Forest of Dean.

Practical teaching could be given in the Forest of Dean (Campbell, 1887, 651-5, 683-91, 711-6), but pupil-labourers could not be taken on to do all the work in the forest, because they would displace local labour (Campbell, 1887, 686-8, 714-6). The Forest of Dean is too uniform (Schlich, 1886, 420-5); it is suitable to some extent, but there are not enough conifers (Pearson, 1885, 540-2, 562, 588-9).

Windsor Forest.

At Windsor there is much to instruct, and the Park there is a field for the study of forest botany (Boppe, 1885, p. 49). It is unsuitable, because not sufficiently varied (Pearson, 1885, 588). The forest should be in Crown lands outside Windsor Park, for economy, because there is already a professor at Cooper's Hill (Pearson, 1886, 9, 36, 59, 106-12, 152-8).

Woods at Cirencester and Downton.

As regards Cirencester and Downton, Bathurst would give every facility to Cirencester students, but would allow no interference in the management (1887, 542-6, 548, 576, 608). Pearson considers Cirencester is not a good centre, because there are no conifers (1886, 62-5, 112, 149-50); but it is pointed out that there is a very good wood of conifers at Tetbury, in addition to Bathurst's beech woods, while the Forest of Dean is within easy reach (McClellan, 1887, 364-5, 376-8, 393-5, 434-5, p. 132). There is a forest "belt" at Downton (Wrightson, 1887, 225-6).

The oak forest at Scone and the Forest of Dean give opportunity for the study of this species (Boppe, 1885, p. 46, 50).

Excursions.

Students should also make excursions to other forests (Pearson, 1886, 58, 83-4, 156-8, 177). Boppe recommends that selected students from Cooper's Hill should be sent for one year to a continental school, and afterwards make a tour of inspection in some mountain forests in France, Germany, and Austria (1885, p. 51-2), while Dyer thinks that students would always be obliged to go abroad for a few weeks (1885, 616-8). McClellan considers visits to forests abroad unnecessary (1887, p. 130).

Research work.

Part of the demonstration forest would be devoted to experiments (Boppe, 1885, p. 51: Pearson, 1885, 537-42; 1887, 37-41; Schlich, 1886, 357-8). Research work would be done at the school (Schlich, 1886, 415-6). Experiment stations for research work are very desirable (Brown, 1886, 211-13). A museum should be attached to the school (Pearson, 1885, 488).

Examinations.

The Committee recommend that provision should be made for examinations by the Board of Forestry (Report, 1887, p. v., vi; Wrightson, 1887, 276-8, 316, 342-4). These examinations should include practical forestry, botany, vegetable physiology, entomology, geology, and subjects connected with land agency (Report, 1887, p. vi.). Agricultural colleges and the Surveyors' Institution might be offered inducements to send students for examination, by exempting from certain preliminary subjects in which they could show proficiency (Report, 1887, p. vi.). A suggestion was also made that the Board might grant certificates to young colonial foresters for theoretical work (Draft Report, 1887, p. xi., par. 17). Witnesses' opinions are to the effect that examinations, open to anyone, and preferably independent of the school, should be held (Clutton, 1887, 1976-9, 2001-3, 2014-7), and that the Highland and Agricultural Society's examinations might be extended (Thomson, 1887, 1172-9, 1281-7). Examinations alone are, however, not sufficient for educational purposes (Clutton, 1887, 2001; Hooker, 1887, 2213-4).

As regards existing examinations, see under Existing Instruction, p. 143.

Board of Forestry.

There should be a Board of Forestry, representative of all the interests concerned (Report, 1887, p. v.; Campbell, 1887, 639-40, p. 134; Clutton, 1887, 1924-31, 1937-44, 1955, 1994-2001, 2008-13; Pearson, 1886, 9). The Board should be presided over by a Government official, an expert for choice, and comprise the principal agencies interested in a sounder knowledge of forestry, especially teaching and examining bodies, as well as the professional societies, three members of each House, and a certain number of owners or managers, preference being given to those in a position to afford facilities for study in their woods (Report, 1887, p. v.; Pearson, 1886, 9). The Board should organise forest schools, or at least regular instruction, examinations, prepare a syllabus and text book (Report, 1887, p. v.). The expense for clerical work and examinations is put at £500, less fees (Report, 1887, p. v.). On the other hand, a Board, as consultees only, from whom owners would be pleased to accept advice, would be desirable (Bathurst, 1887, 615-19; McClellan, 1887, 382, p. 131); and Wrightson advocates a Board for examination only (1887, 276-8, 316, 342-4).

Appendix II.

APPENDIX No. II.

DIGEST OF CERTAIN PUBLICATIONS BEARING UPON THE OBJECTS OF THE INQUIRY.

(i.) FORESTRY IN FRANCE. BY LIEUT.-COLONEL F. BAILEY, R.E.

[*Transactions of the Royal Scottish Arboricultural Society, Vol. XI., Part ii.*, 1886.]

The *Higher School* at Nancy, where candidates for the superior staff receive their training, has an establishment of thirteen professors and assistant professors. The course, which extends over two years, comprises thirteen months of theoretical and five months of practical work, and two months of examinations. The amount spent by the State on each student during his course of training amounts to about £350. An area of 7,500 acres of forest, situated near Nancy, is placed under the control of the director of the school, for use as a field of practical instruction, as well as for various experiments and researches, to carry out which an assistant inspector is attached to the school staff. The school is well equipped with a very complete museum, a library, a chemical laboratory, and a large collection of models.

The *Secondary School* at Barres is maintained in order to facilitate the entrance of subordinates into the superior staff by the education of such of them as may be deemed otherwise fitted for advancement. The course extends over two years. The teaching is conducted by three professors, who are officers of the superior staff; but additional teachers who are not forest officers can be employed when their services are required. The school is established on a property purchased by the State from an owner who had raised on it a large number of exotic trees of many kinds. There is also on the estate a small forest, which, with a neighbouring State forest, is used for the practical instruction of the students. The buildings comprise residential quarters, classrooms, and a museum. The students, who are lodged at the school, receive from the State an allowance of £2 per month to provide themselves with food and clothing.

The *Primary School* is a branch of the establishment at Barres, the instruction being given by the director and professors of the Secondary School. It is reserved solely for the education of the sons of forest officers and subordinates, who may desire to enter the Government service as forest guards, with a view, in most cases, of ultimately gaining the ranks of the superior staff through the Secondary School.

Candidates must be between 24 and 27 years of age. They are obliged to pass an entrance examination in dictation, French composition, arithmetic, elementary geometry, and French history and geography. While at the school they are styled "student guards"; quarters are provided for them, and they receive from Government a part of their uniform, and an allowance of £1 16*s.* a month, to provide themselves with food and clothes.

The course occupies eleven months, and embraces the following subjects, viz., arithmetic, plane geometry, algebraical signs, surveying, and levelling, the French language, French history and geography, the elements of sylviculture, the elements of forest botany (including vegetable anatomy, physiology, and the classification of the principal forest trees), and the elements of forest law and administration. The instruction is given partly in the class rooms, and partly in the form of practical work done in the forests.

The average annual net surplus of receipts over expenditure from the French State forests, taken over a period of three years, was about 7*s.* per acre.

(ii.) FORESTRY IN HUNGARY. BY LIEUT.-COLONEL F. BAILEY, R.E.

[*Transactions of the Royal Scottish Arboricultural Society, Vol. XII., Part i.* 1888.]

The *Academy* at *Selmeczbanya*, which is maintained for the training of candidates for the superior (State) staff, with a smaller number of mining engineers, is conducted by a staff of six professors. The ordinary course extends over three years. Fees are not charged, and twenty scholarships of £24 each are given to those among the poorer students who are found to have done the best. There is a magnificent library and a very complete museum containing specimens and models. Some forests near the school are placed under the control of the director for purposes of instruction.

Secondary Schools.—Two such schools are supported by the National Forests Fund[*]; a third was, in 1886, about to be established. The course of instruction extends over two years. The students are maintained either by the State or from the National Fund, or by private persons who may send them to the school. Each school has a staff of three professors, one of whom acts as director.

(iii.) PRESIDENT'S ADDRESS, ROYAL SCOTTISH ARBORICULTURAL SOCIETY. BY LIEUT.-COLONEL F. BAILEY, R.E.

[*Transactions of the Royal Scottish Arboricultural Society, Vol. XVI., Part i.*, 1899.]

It is a common saying here that woods will not pay. It is stated that our soil and climate are unfavourable to sylviculture; but no one has explained what is wrong with either the one or the other, and the magnificent isolated trees that adorn our parks and policies disprove the statement. It is said that we lack sunshine; but we are probably not worse off in this respect than the countries surrounding the Baltic, from which we import so largely.

Woods, and especially coniferous woods, develop vigorously on very poor soil; and with the exception of our higher uplands, our comparatively mild and humid climate appears eminently suited for the growing of woods.

Sporting and æsthetic considerations interfere with the practice of correct sylviculture; and this is not surprising, seeing that in the sale of landed estates in Scotland, standing woods are often reckoned as of no value.

We ask for a small State forest, to serve as a model

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[*] This fund is mainly supported by the payment into it of a proportion of the fines levied from persons convicted of forest offences and of sums paid under the law for the compounding of offences. Its revenues are also devoted to the raising of plants, the publication of professional works, etc.; they are supplemented by grants from the general forest budget of the State.

Appendix II.

and as a field of practical instruction for students of forestry. There is perhaps no science for the effective teaching of which practical demonstration is more essential. It is impossible to convey a correct idea of many of the most important sylvicultural processes by the use of words and diagrams; and for instructional purposes it is absolutely necessary to have convenient access to woods which have been correctly managed for a long time.

Experts are agreed that we are within a measureable distance of a wood-famine, or at least, of a scarcity, which must cause a rise in prices; and it will be to the interest of owners if their estates can be put into a position to profit by such a rise. This will also be to the interest of wood-managers, who may reasonably expect that the efficient management of a more profitable business would lead to an improvement in their position and prospects.

But to secure this end, a large proportion of our woods must be managed on business principles, under a working plan or management scheme, which may serve to avoid, to a great extent, the evils inherent in changes of owners and managers. The proprietor of the day is entitled to take the annual growth or increase of his woods; but without such a scheme he has no means of knowing whether he takes more or less than he is entitled to. Again, under a regular plan of management the markets are regularly supplied, to the great advantage of both the owner and the timber trade.

(iv.) Establishment of State Model Forests for Scotland. *

[*Trans. Roy. Scot. Arb. Soc., Vol. XV., Part iii.*, 1898.]

Both M. Boppe and Professor Schwappach criticised adversely the condition of our woods, and Dr. Schlich says that our home-grown timber is, generally speaking, inferior in quality to that imported from abroad. He remarks that it comes into the market at irregular intervals and in fluctuating quantities, and that a more complete knowledge of systematic forestry is required by those engaged in the formation and management of woods to be worked on economic or commercial principles. Many reasons may be given why we have exposed ourselves to adverse criticism. In regard to the sylvicultural methods followed in France, Germany, and other European countries, although doubts are expressed as to their suitability to our conditions of soil and climate, a strong desire is very generally evinced that practical proof should now be given of the extent to which methods of treatment, which are successfully employed in other countries, can be applied to our own forests.

We produce a limited quantity of timber of first-class dimensions and quality, but most of our home-grown wood is certainly inferior in quality to that which we obtain from abroad; and this is so far recognised that the former is but little used for purposes of construction by either Government or by private persons. The Postmaster-General, having been requested to try home-grown Scots fir for use as telegraph posts, replied that this wood is less strong than the Norway red fir commonly used by his department, and that it is less straight, and less free from large and rough knots. He added that the difficulty and delay experienced in obtaining even small parcels of Scots fir suitable for telegraph posts rendered it necessary to resort to the Norwegian market in order to obtain adequate supplies. Miners pay high rates for foreign pit-wood.

But, while our consumption of forest produce is steadily increasing, Dr. Schlich has shown that the permanence of our supply of timber from abroad is very far from being assured, and that thus we may before long find ourselves face to face with a scarcity which must lead to an enhancement of the price of timber. Large areas of unoccupied land are available for planting, and we may feel confident that the introduction of remunerative sylvicultural methods will lead to the area under forest crops being largely added to, and to our becoming less dependent than we are at present on supplies from abroad.

State Model Forest Required.

Owners of waste lands suitable for profitable afforestation might be ready to plant, if a practical object-lesson could be presented to them, demonstrating the methods by which a fair return on their outlay could be assured. We want a model forest, first of all in order that we may be able to prove that economic forestry, as taught and practised in Germany, France, and other countries, would yield equally good results under our own conditions of soil and climate. Dr. Schlich and M. Boppe agree in the opinion that, under improved sylvicultural treatment and under systematic working, we can produce timber just as good as that which is grown abroad.

A model forest is also required for conducting experiments and researches, and as a field of practical instruction for students. In regard to the latter requirement, Dr. Schlich insists on the necessity for adequate field instruction, given in forests managed on the right lines, where students can see the theory of economic forestry practically illustrated. M. Boppe urges that every forest school should have attached to it a forest which has, for some time past, been under scientific management; without it, he says, the best theoretical teaching in the world would be of no avail. During his tour in Great Britain, however, he did not find a single forest suitable for the teaching of sylviculture; and it is evident that even the best managed private forest estates lack that continuity of aim and action which alone could fit them for educational uses.

Forest Schools.

State forest schools are maintained in France and Germany, with forests in the neighbourhood which are under the control of the Director of the school. To the Coopers Hill College a portion of the Windsor Forest is attached, but on account of the absence of suitable forests in this country, the students receive the principal part of their practical training in the State forests of Germany and France. Forests used as training grounds for students must be placed under the control of the Director of the school, in order that they may be made to serve their educational purpose in the fullest possible manner.

Considering that we are without extensive State forests, the number of students who, at the present time, might be expected to enter an independent and fully equipped forest school would probably not suffice to provide funds for its maintenance; and the only plan now feasible seems to be to teach forestry in some University or college, where instruction in the auxiliary subjects, such as botany, chemistry, geology and mineralogy, entomology and engineering, is already obtainable. It is true that such an arrangement has drawbacks. Under it the practical training ground must be at some distance from the classrooms, and the auxiliary subjects are taught without that special reference to the requirements of forestry which is so desirable, and which cannot be secured otherwise than at a special school.

In Edinburgh three courses of lectures are given:—

1st.—That delivered daily, during the winter session, at the University, to a small number of students who are following other courses, and who, for the most part, wish to qualify as estate managers; but there have been also a few sons of landed proprietors, a few men seeking a career in the Colonies, and others whose aim was to become farmers, and who elected forestry as one of the alternative subjects prescribed for the degree of Science in Agriculture. In addition to classroom lectures, these students are given such practical instruction as is found possible in neighbouring woods, nurseries, saw mills, timber yards, creosoting works, &c.

2nd.—Weekly evening lectures at the Royal Botanic Garden to a class which last winter (1897-98) numbered 16 foresters and 15 gardeners. It extends over three years, during which time about 40 lectures in forestry are given.

3rd.—Weekly evening lectures at the Heriot-Watt College, where, during the winter of 1897-98, about 30 students assembled. They were for the most part clerks and law apprentices, foresters, gardeners, nurserymen and seedsmen. They were employed in the city and neighbourhood, and could not attend day classes, nor follow courses of study elsewhere.

The course at the University is fuller than the other two, but its value would be greatly enhanced if a model forest were available for practical instruction. A few only of the ex-students have sought to follow the career of wood manager; but it may reasonably be hoped that as proprietors come to realise the advantages of bringing their woods under a regular system of management, the prospects of wood managers will improve, and that young men who desire to follow this career will then attend the class.

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* Adopted by the Royal Scottish Arboricultural Society, on 25th May 1898 as embodying their views on the subject.

In existing circumstances, the present classes meet a want; and it can hardly be doubted that the lectures given in Edinburgh have had a share in removing the prejudice with which, until recently, sylvicultural innovations were generally regarded in Scotland.

Location of the Model Forest.

Edinburgh is the only place in Scotland where lectures on forestry are now given. It is better to concentrate our efforts in one place, and leave nothing undone to improve the teaching there, than to dissipate our strength in attempts to sustain the machinery of instruction in several places. Dr. Schlich entirely supports this view. He advocates: "One centre of instruction, consisting of (1) theoretical instruction in connection with a University or Agricultural College, where instruction in the auxiliary sciences is already provided; (2) woodlands where practical instruction can be imparted, because in forestry theory and practice must go hand in hand. As regards the first point, theoretical instruction, a beginning has been made in this very city (Edinburgh). . . . The arrangement needs only further development, and to be put on a proper footing, so as to bring the subject of forestry, as regards its importance, on a par with other branches of learning."

The estate to be acquired for purposes of practical instruction should possess a considerable proportion of growing woods, of as many species as possible. For these woods it would be necessary to frame a working plan, which would lay down the general lines of management; and to appoint a manager, who should be a man of the highest professional attainments. A Board of Visitors should be appointed, who would report to the Board of Agriculture.

Estimates and Provision of Funds.

It has been estimated that the cost of from 1,500 to 2,000 acres of land within easy reach of Edinburgh, and including some 500 acres of growing woods averaging 40 years of age, would not exceed £40,000; that the net annual income from such an estate would not be less than £1,000, and might be as much as £1,500; and that this income, with an annual grant of £500 from Government, would meet all charges for maintenance. The property would be vested in the State.

It seems reasonable to ask the Government to take the first step towards a much-needed reform in our wood management, by providing a State Model Forest in connection with the existing School of Forestry at Edinburgh. The difficulties which oppose themselves to private action in this direction are so strong, and the importance of the interests involved are so great, that it may confidently be said that of all enterprises to which the State might ōffer aid or encouragement, forestry is that which has the strongest claims on the consideration of the Government.

(v.) THE PROPOSED SCHOOL OF FORESTRY. BY SIR DIETRICH BRANDIS, K.C.S.I.

[*Transactions of the Royal Scottish Arboricultural Society, Vol. XII., Part i.*, 1888.]

After alluding to the great differences between the forest conditions of India and Scotland, particularly as regards rights of users, and State and individual proprietorship, attention is directed to the manner in which forest business is managed on the continent of Europe.

In Prussia, for instance, the area of the State forests alone amounts to 6,600,000 acres. More than twice this area is in the hands of towns, villages, public corporations, and private individuals. The whole of the large forest area of Prussia—upwards of 22,000,000 acres—is managed on a regular system, with the object of maintaining a uniform annual yield in wood, timber, and other forest produce, the amount of which over a large portion of the area is slowly increasing every year, as the result of the steady improvement which takes place in the condition and, consequently, the productive powers of the forests. The number of the superior officers entrusted with the management of the Prussian State forests is 807.

The training of the superior forest officers in Prussia consists of a practical apprenticeship of one year in one of the State forest districts after leaving the public school, two years' study in a forest school, one year at a university, and two years' practical work in several forest districts. Examinations have to be passed at the end of the university course, and again after the two years' practical work, after which the candidate is eligible for the State service. At this time the candidate is usually about 26-27 years old. Generally, however, he has to wait a few years before obtaining a permanent Government appointment in the lowest grade of the superior staff. Those who do not obtain such posts find employment in forests belonging to towns, villages, corporations, or private individuals. In other parts of Germany the arrangements are similar: everywhere a thorough and prolonged professional training, partly practical, partly theoretical, is required of candidates for the superior State service.

It is hoped that the course of training for the highest appointments in the Indian service, which is at present two years at Coopers Hill, will ultimately be made as thorough as is the case in Germany. But such a course as this is not of special interest to Scotland, where the requirements of wood-managers and foresters are entirely different from these of Indian forest officers. The elaborate professional and scientific training of those who aspire to the highest posts in India should be kept entirely distinct from the establishment of forest schools for wood-managers and foresters in this country.

In Prussia and other countries of the continent of Europe, the State is the largest forest proprietor; moreover, it is justly held to be the duty of the State to watch over the good management of the forests which belong to towns, villages, and public corporations. It is different in Great Britain, where, out of a total area under timber of about 2,800,000 acres, the Crown has only about 100,000 acres, while the rest belongs to private proprietors. In the United Kingdom the condition of things is similar to that which exists in some parts of Austria, notably in Bohemia and Moravia, where the large forest proprietors have formed two associations for the purpose of providing professional education for young men who desire to enter their service as wood-managers or foresters. The professional education for the State forest service in Austria was considered too high and too expensive for the requirements of these private estates; the proprietors therefore determined to help themselves. The Bohemian school at Weisswasser was established in 1855; students are required to pass through a middle-class school, and to serve a practical apprenticeship of twelve months, after which the course of studies at the school occupies two years. A forest district of 2,900 acres, belonging to a private owner, is attached to the school, and placed under the control of the director for purposes of practical instruction. Under the director is a staff of five professors, one for those branches of forestry not taught by the director himself, one for mathematics and surveying, two for natural sciences, and one for drawing and book-keeping. Eulenberg, the school maintained by the Association of Forest Proprietors of Moravia and (Austrian) Silesia, was founded in 1851, and has a similar organisation. No fees are paid by sons of foresters.

As soon as the desire gains ground among proprietors in Scotland to obtain for their estates the services of wood-managers and foresters who have received a more systematic professional training than is attainable at present, they will find the needful means and take the needful steps for the establishment of a forest school. It clearly is their interest to increase the annual yield, and to improve the productive powers, which means the capital value, of their estates. These ends may to some extent be accomplished by a more systematic management of their woodlands, and this again will be promoted by giving to foresters a more systematic training in their profession than they receive at present.

The natural and proper thing in the present case is for the proprietors to take action on their own account. Should this, however, not be the case, and should the Royal Scottish Arboricultural Society feel themselves strong enough to take the initiative in such an undertaking, this would be an excellent and most important step. The large landed proprietors might perhaps afterwards be disposed to take up the scheme and work it out on their own account. Something of this kind took plate at Weisswasser, which was at first established by the Bohemian Forest Society, and which was thus continued until 1862, when the forest proprietors of the province took over the institution.

Much of the highest interest to the forester may be seen and learnt in the Scottish woodlands. Different methods of forestry have been practical under widely different circumstances, in some cases with marked success, while in other cases there have been failures. A forest school, if the teaching is of the proper kind, will contribute much to a better understanding of the circumstances which have led to success in the one case and to failure in the other. The students will be taught to observe accurately, to combine their own observations with the theoretical knowledge they have acquired, and this will eventually enable them to draw correct conclusions from the facts which they have observed. The school, if well directed, ought to become a centre of scientific research, the results of which will contribute much to a more successful management of the woodlands.

(vi.). President's Address, Royal Scottish Arboricultural Society. By Isaac Bayley Balfour, F.R.S., August 1891.

[*Trans. Roy. Scot. Arb. Soc., Vol. XIII., Part ii.*, 1892.]

The society has from the first perceived that the way to improve forestry was by educating those who have the care and management of woodlands, and this object has been steadily pursued. Not until it had attained its majority, however, did the society see the first step taken in this direction—viz., the acquisition by the Town Council of Edinburgh and the Crown of what is now the Arboretum. The next important step was the organisation of the Forestry Exhibition at Edinburgh, partly with the view of obtaining funds for the endowment of a chair, though these hopes were not realised. The appointment of the Select Committee on Forestry in 1885, which, however, led to nothing, may also be traced to the society's efforts. A fresh impetus was given in 1889 by the arrival of Dr. Somerville as lecturer at Edinburgh University, with the assistance of a temporary grant of £100 per annum towards his salary from the newly established Board of Agriculture. Apart from university work, a short course of lectures was begun at the Royal Botanic Gardens by him and the Keeper of the Garden during the winter months.

The necessity of forest education is now fully recognised: what is wanted is practical support from those whose interest it is to encourage good forestry. As far as possible, existing institutions must be utilised; schemes for the creation of a forest school in a district surrounded by forests would involve a maximum of cost.

There are two classes requiring education: (1) Those who can afford university education—owners, land agents, and persons proposing to enter the higher grades in India or the Colonies; and (2) the practical forester, below university grade.

In the university a student can already obtain instruction in all the sciences underlying forestry; and application has been made to the Universities Commissioners to recognise forestry as an applied science, on the same footing as engineering and agriculture, by the institution of a chair of forestry.

The chief difficulty with the working foresters is the maintenance of the pupil during the period of instruction; bursaries would help them to some extent, but not sufficiently. Prof. Balfour believes that it can best be done by utilising the Royal Botanic Garden, and he has submitted to his department a scheme, according to which students would be enrolled as workmen, and while receiving the usual wages and performing all the regular labour of the Garden, would attend lectures twice a week on forestry and cognate subjects for a period of two or three years without fee. Only a limited number could thus be received as "garden pupils," but arrangements might be made to admit others to the courses. The expense he puts at not more than £150 per annum for lectures.

(vii.). President's Address, Royal Scottish Arboricultural Society. By Isaac Bayley Balfour, F.R.S. August, 1892.

[*Trans. Roy. Scot. Arb. Soc., Vol. XIII., Part iii.*, 1893.]

In continuation of his address in the previous year, Prof. Balfour noted, with regard to university education in forestry, that the Edinburgh University lectureship, vacated in 1891 by Dr. Somerville, had been continued under Colonel Bailey. Some money had also been raised, but only about a fourth of the sum required, towards the endowment of a chair of forestry. The position of forestry had also been recognised by the Universities Commissioners approving it as an optional course for the degree of science in agriculture. Prof. Balfour urged the necessity of its being a compulsory subject.

As regards training of practical foresters, a great advance had been made by the sanction of the scheme drawn up by himself for the education of pupils who should maintain themselves during the period of instruction as workmen in the Royal Botanic Gardens. Arrangements had been accordingly made to take foresters or gardeners, with at least three years' previous practical experience, as employees receiving regular wages in the Garden for two and a-half years; while several nurseries about Edinburgh had also agreed to take such men and allow them to attend the courses, which would be arranged so as not to interfere with the daily work.

(viii.). Forestry in Britain: President's Address to the Biological Section of the British Association, 1894. By Isaac Bayley Balfour, F.R.S.

[*British Association Report*, 1894, *p.* 667.]

Forests are of importance to a country from two aspects—as a source of timber and fuel, and on account of their hygienic and climatic influences. These latter have now been clearly demonstrated. Stated generally, forests improve the soil drainage, exercise a purifying effect upon the air, prevent the dissemination of dust particles with their contingent germs, reduce extremes of temperature, increase the relative humidity of the air and the precipitation in rainfall, and protect and control the waterflow from the soil.

Forests in this country are not of great importance as a source of fuel, but the insufficiency of our woodlands to supply our requirements of timber is shows by our large annual imports, a considerable proportion of which could be grown at home. The consumption of timber will probably increase; science will no doubt, as in the past, find substitutes for many objects for which wood is now used, but, on the other hand, this saving will probably continue to be counterbalanced by the greater utilisation of wood in new directions. There is abundant evidence that the present rate of timber consumption is in excess of the present reproduction in the great timber supplying countries. In Northern Europe the supplies are rapidly diminishing—even Sweden is beginning to import logs from America—and both Canada and the United States are beginning to show signs of exhaustion.

Great Britain has a far smaller area under wood than other countries, and the area under State woods is also much less, although State proprietorship abroad is not so large as is sometimes supposed. But continental States recognise the national importance of forests; and the example they set in the management of their own

Appendix II.

woods, their readiness to give advice, and the education they provide, have resulted in the private woods being as well managed as those of the Government; whereas in this country the State forests cannot in any sense be regarded as models, and in the New Forest legislation has even prohibited the practice of forestry.

Some of the mismanagement of our woodlands is due to the conditions of land tenure; copyholders can hardly be expected to plant. Game is also frequently preferred, and is often more remunerative. Much mismanagement is also due to want of scientific knowledge on the part of landowners; while the operations of planting for posterity, with very rare possibilities of any return to the planter, make demands upon the landowner to which he is unequal.

It is sometimes said that wood will not pay in Britain; and the home grower is certainly handicapped to some extent. The use of foreign timber only is often specified in building contracts, and even the Post Office two years ago debarred the employment of native timber for telegraph poles. Yet the quality of home timber is quite as good as foreign. The grower suffers also by not maintaining a steady and regular output. This can be remedied by proper management, and an instance may be quoted of larch yielding 9s. per acre, after paying all expenses, while contiguous land was only worth 1s. or 2s. per acre as grazing. The woods also give considerable employment, and thus help to retain the rural population on the land. In the instance just quoted the outlay for labour amounted to 31s. per acre per annum.

The State ought to treat its forest areas in a reasonable and scientific manner, and be prepared to incur the opposition of those who regard all scientific handling of woods as vandalism. Such tracts properly treated might serve as instruction areas. The creation of some such experimental teaching stations in Government forests is one of the essentials for forestry in Britain; and the area of State ownership should even be increased to provide centres of instruction, with an acreage sufficient to allow of a satisfactory rotation, in other parts of the country.

The general ignorance regarding forestry was recognised by the Select Committee in 1887, and in their report they recommended as remedy the appointment of a Board of Forestry. This is now rendered unnecessary by the formation of the Board of Agriculture, which body ought, however, to have competent scientific advisers upon its staff, and such an expert in forestry would do much to increase sound technical knowledge in Britain.

The few courses on forestry at various institutions started since the report of the Committee was issued, mostly with the aid of grants from the Board of Agriculture and local help, are nothing to what is required. Two points arise in connection with the provision of a complete scheme of forestry instruction—viz., where are the funds to come from, and where are we to get the teachers?

As regards the funds, the Board of Agriculture will no doubt be willing to contribute, but their aid will be dependent upon local support. It is to the county councils that we must look for the necessary endowments, with, it may be, some assistance from private benefactors; while the Government must provide the sylvicultural areas for practical instruction. But before we can get the county councils to move, the nature of the national interests involved must in the first place be made more widely known.

For the teachers, we must look to the botanists. It was its utilitarian side, and its practical application to medicine, which gave the first impetus to the study of botany. But this science subsequently became less practical, and botanists have failed to recognise the natural outlets of their study. Modern botanical study should, through forestry, find a sphere of application by which it may contribute to our well-being. For the present we must depend for our teachers upon men trained abroad, but the studies of botanists can be so moulded as to put them on the track of this practical subject.

(ix.). Report on a Visit to the Forests of Scotland, Aug., 1896. By Dr. Adam Schwappach, Professor of Forestry in the Prussian Forest School of Eberswalde, and Director of Prussian Forestry Investigation.

[*Trans. Roy. Scot. Arb. Soc.*, *Vol. XV.*, *Part i.*, 1896.]

Professor Schwappach visited the woods in the districts of Loch Lomond (Airthrey, Keir, Blair Drummond, Lanrick Castle), Fort William, the Caledonian Canal, Inverness, Strathspey, and Strathtay. He found "the most scientific system of forestry, according to German notions, in the large pine forests belonging to the Countess of Seafield, in the neighbourhood of Grantown. . . . The older woods are showing satisfactory growth and, with the exception of those in the neighbourhood of the castle, are exclusively regenerated by naturally-sown seed. At Curr Hill it was an interesting experience for me to find a wood about twenty years old and a hundred acres in extent, which had been regenerated naturally, and which was showing a density and uniformity which, without artificial assistance, could not have been obtained in Germany, where the young trees suffer much during the felling of the seed-trees." In other woods on the estate he found things less satisfactory, and he expressed the opinion that it would certainly have paid to give more attention to filling up by artificial planting gaps that were left in the naturally-sown woods. He also reported: "When at Grantown, I had also the pleasure of inspecting a wood, about twenty years old, . . . which had been established by planting, and which was growing in a most satisfactory manner . . . The main difference in the management of woods in Scotland and in Germany is found in the manner of thinning. The specimens of thinning that I met with at Dunkeld, Scone and Airthrey were entirely opposed to what we consider good practice in Germany. . . . It seemed to me . . . that woods are greatly overthinned in Scotland. . . . The great mistake that Scottish foresters make is to start thinning too early, in order to give the trees sufficient room to develop large crowns, and to grow rapidly in thickness . . . However desirable early returns may be from the point of view of the landlord or of the forester, the fact must not be lost sight of that they are obtained at a great sacrifice . . . At Scone Palace, I inspected a very fine oak-wood, 90-100 years old. The trees were showing vigorous growth, and one can only regret that the ground was not more fully stocked, as would have been the case under a different system of management, and which would have resulted in the production of finer and more valuable stems." Between Callander and Balmaha he saw much oak coppice. "But, with tanning bark as the main object, the manner of thinning appeared to leave much to be desired."

He discusses the afforestation of waste lands, at present used for grazing and sporting. "The annual grazing and sporting rent from such areas appears to fluctuate between 6d. and 2s. 6d. per acre. The question then comes to be whether forestry offers the opportunity of improving the revenue from such land. The favourable climate of Scotland and the comparatively easy slopes of its mountains, make it unnecessary to undertake forestry operations for the improvement of the climate, or the fixation of the soil upon the hills. The ease with which coal may be got in that country, and the facilities which it enjoys—at least for the present—for the importation of timber from abroad, make it unnecessary that planting should be undertaken either for the purpose of providing a supply of fuel or of structural timber. The possibilities of the afforestation of the waste lands of Scotland, must therefore be regarded entirely from the financial point of view. Whether forestry will be financially successful or not will to some extent depend upon whether the question is regarded from the national point of view, or from the standpoint of the owner of the woodlands for the time being.

"Regarded from the point of view of the national weal, the question comes to be whether forestry offers the possibility of permanently increasing the nett revenue from the land. In my opinion this question must undoubtedly be answered in the affirmative, at least so far as the better classes of soil are concerned, and for the following reasons. Assuming that the Scots fir is employed, with a rotation of eighty years on soil of the third class and, further, allowing 2½ per cent. on the invested capital, a percentage which for Britain errs on the side of being rather too high than too low,

Appendix II.

we have the following items of expenditure and revenue, so far as they refer to the first rotation:—

EXPENDITURE PER ACRE.

		£	s.	d.
1.	Value of land worth 1s. 6d. per annum at twenty-five years' purchase - -	£1	17	6
2.	Planting and beating up - - -	1	10	0
3.	Annual outlay for supervision, protection, rates and taxes, and road-making - - - - - - -	0	2	0

"By the methods of computation employed in forest valuations, the deferred value of these items of expenditure, with compound interest, at the end of eighty years amounts to about £49.

"According to my investigations, the final felling and the deferred value of the intermediate returns (thinnings) allowing, however, only 2 per cent. interest on the latter, will amount at the end of eighty years on soil of the third class to £87. Distributed over eighty years, the balance of £38 gives an annual revenue of just over 3s. per acre, which compares with a former rental of 1s. 6d.

"Although nothing has been allowed on account of game in the above calculations, it is not to be supposed that no revenue will be derived from this source during the whole period of the rotation. On the contrary, the game rent, during the second half of the rotation of a German forest, amounts to a very considerable sum.

"Apart from the increase of revenue, the afforestation of land is of great national importance as a labour-employing industry. Land under wood can maintain a larger population than land under rough pasture. From the national point of view, it is manifestly also an advantage to produce timber at home, and so dispense with its importation from abroad. This matter is of special importance, in view of the fact that many countries which at present export timber must in the near future cease to do so. Many of these countries are exploiting their forests in such a reckless manner that their stock of timber will soon be exhausted."

He derived most pleasure in his tour from the opportunities he had of inspecting the exotic conifers so common in many of the parks and pleasure-grounds of Scotland. It is only within the last 20 years that much attention has been given to this subject in Germany, so that the much older exotics which Prof. Schwappach met with proved of special interest to him. "The parks which I visited differed in character and situation to some extent, but all of them were pictures of sylvan beauty. To a stranger accustomed to a Continental climate, the splendid collections of conifers came as a revelation, and it would be difficult to say which of them was the most interesting. To me, as a forester, Murthly appeared as the pearl of them all. It was here that I found American conifers in the greatest abundance and of the largest size, and the trees had been treated here more as one is accustomed to meet with them in the forests. The magnificent development of the different species, and the picturesque and artistic manner in which they were grouped, with luxuriant specimens of rhododendrons, hollies, bay laurels, and other plants, combined with the beautiful velvety turf of the Scottish lawn, produced an impression never to be effaced. Seeing that some of the more important European trees do not in all cases grow very satisfactorily in Scotland, I should recommend that the North American conifers should be planted on a larger scale, as is now being done in Germany. The spruce, for instance, does not yield a satisfactory growth in many parts of Scotland, and this is also found to be the case near the sea coast in other countries, as, for instance, in Schleswig-Holstein. Many parts of Scotland, also, do not offer what I would consider very suitable conditions for the growth of the Scots fir. True, rabbits will materially interfere with the success of the cultivation of exotic trees and with forestry operations in general, but there is no reason at all why this difficulty should not be overcome.

"Not only do many of the exotic trees give a larger yield of timber than the indigenous spieces—compare, for instance, the yield of woods of Scots fir and Douglas fir of similar age at Scone—but they also furnish timber of superior quality. This point gains additional importance in view of the fact that the American supply of timber of many valuable speices is within measureable distance of extinction. Scotland possesses the most favourable natural conditions for producing those high class timbers which America will soon cease to supply. I regard the evidence of the successful growth of exotic trees in the parks of Scotland as of far greater natural importance than the beautifying influence which these trees exert upon the landscape. . . . In conculsion, I may shortly summarise the points that appeared to me to have the most important bearing on the future of forestry in Scotland:—

1. In selecting the trees to be cultivated, more regard should be paid to the character of the situation.
2. The stocking, whether artificial or natural, should be denser. In the latter case, gaps amongst the seedlings should be early and carefully filled up by artificial transplantation.
3. The woods should be managed on sylvicultural principles, and not in the park-like manner at present in vogue.
4. The operation of thinning should be conducted in a more rational manner, and with more regard to the future of the wood.
5. A broader view should be taken of the whole financial aspects of forestry. The success of forestry operations cannot be judged from the æsthetic point of view, nor can it be gauged by the immediate returns; it can only be determined by the difference between the deferred or final sum of all the items of revenue and of expenditure.
6. Considerations of sport should be permissible only when they do not interfere with the production of timber, which is, of course, the main object of forestry."

(x.) BRITISH FORESTRY AND ITS FUTURE PROSPECTS. BY JOHN NISBET, D.OEC.

[*Trans. Roy. Scot. Arb. Soc., Vol. XVI., Part iii.*, 1900.]

In former times, the growth of oak was encouraged in view of the necessities of the Navy, but, with the substitution of iron for timber, etc., of late years, the need for hardwoods has become less pressing. Great quantities of teak, etc., are now imported, and with regard to these particular classes of hard woods, neither the present nor the future condition of the forests in Britain will exert much influence upon the market demand, and it is probable that increased supplies, not yet remunerative, will become available in the future.

It is otherwise with the light woods. Of the total imports of £25,378,000 for timber and other tree-products in 1899, we spent about £18,000,000 on coniferous wood alone, which could easily and profitably be grown at home. And these imports have increased of late years. The two great sources of supply of coniferous wood are the Baltic countries and Canada; and the demands of industrial countries, especially of Germany, in the case of the first-named, and of the United States in the second, will absorb a very large proportion of their available surplus. Canada uses about £16,000,000 worth of timber per annum, the value of the wood-products exported being £5,000,000 to £6,000,000. The United States cannot meet its own requirements of timber, and the growth of industries, more especially the extraordinary development of the manufacture of wood-pulp, must make very heavy demands on the Canadian supplies in future.

These circumstances render a rise in the price of timber certain, and the days of cheap timber in Great Britain are almost at an end. Britain's requirements cannot be entirely met at home; even if the 3,000,000 acres of woodlands were trebled, and were in a fully stocked condition, they would only just supply existing needs, without any margin for expansion of industries. And, with few exceptions, British woods are neither fully stocked nor well managed. There have been of late, however, some hopeful signs that landowners are awakening to the fact that their woods might be improved, and several have had working plans drawn up by experts. For the proper management of woods, and a regular revenue, a working plan is essential.

State aid for instruction in forestry is wanted on a more generous scale than has hitherto been given. At present the only thorough instruction given is at Cooper's Hill, but the expense there is too heavy. The State

Appendix II.

should provide either a national school, or cheap courses at some of the universities and agricultural colleges, or, rather, technical schools. The courses at Edinburgh University, Newcastle, and the Botanic Garden at Edinburgh—all State-aided—are only initial steps in the proper direction. All important European States have one or more forestry schools, and even the State of New York has founded a College of Forestry with 30,000 acres of demonstration forest.

There are many works on sylviculture, and doubtless the State and other landowners who may have had working plans drawn up will allow their estates to be inspected by students. It therefore seems far more important to provide first of all thoroughly adequate, cheap, and easily obtainable instruction than to acquire and work a State model forest in Scotland.

Substantial encouragement and assistance must also be given by the State to induce landowners to adopt economic forestry. The Government might give facilities for the advancement of money at a low rate of interest; the management, if necessary, being subject to the approval of the Board of Agriculture. There are objections to the State lending such money directly, but amendments in the necessary direction might be made to the Lands Improvement Act, etc.

Other difficulties in the way of economic forestry are the rating of woodlands, the law as regards damage by sparks from railway engines, and rabbits.

(xi.) THE OUTLOOK OF THE WORLD'S TIMBER SUPPLY. BY DR. W. SCHLICH, C.I.E., F.R.S.

[*Journal of the Society of Arts*, *March* 1, 1901.]

I shall begin with Europe, and then deal with non-European countries. My data referring to the former are fairly complete, which, however, cannot be said of those referring to the latter.

The first table to which I desire to invite your attention is that which shows the areas classed as forests in the several European countries.

Table I.

Showing the Area of the Forests of Europe.

Countries.	Area of Forests, in Acres.	Percentage of Total Area of Country under Forest.	Percentage of Forest Area belonging to the State.	Forest per Head of Population, in Acres.
1. Sweden	48,000,000	44	27	8·9
2. Norway	17,000,000	21	12	8·4
3. Russia, including Finland	516,000,000	40	61	5·9
4. Bosnia and Herzegovina	6,790,000	53	70	4·9
5. Bulgaria	10,650,000	45	—	3·2
6. Spain	20,960,000	17	84	1·3
7. Hungary	22,420,000	28	16	1·3
8. Austria proper	23,990,000	32	7	1·0
9. Servia	2,390,000	20	—	1·0
10. Roumania	5,030,000	17	47	1·0
11. Greece	2,030,000	16	80	·9
12. Luxembourg	190,000	30	—	·9
13. Switzerland	2,100,000	20	4	·7
14. Germany	34,490,000	26	33	·7
15. France	23,530,000	18	12	·6
16. Italy	10,110,000	14	4	·3
17. Denmark	600,000	6	24	·2
18. Great Britain	3,030,000	4	3	·1
19. Belgium	1,250,000	17	5	·1
20. Portugal	770,000	3	8	·1
21. Holland	570,000	7	—	·1
22. Turkey	6,180,000	8	—	—
	758,080,000	31	—	2·

This table at once introduces some very useful information, the main points of which may be sumarised as follows:—

1. Not quite one-third of the area of Europe is classed as forest.

2. The average forest area per head of population ranges from 9 acres to one-tenth of an acre, the average being about 2 acres.

3. I have underlined the areas referring to the exporting countries. Of these, only Austria-Hungary and Roumania have less than 2 acres per head of population; all other exporting countries have from 5 to 9 acres of forest per head of population.

Table II.

Showing the Net Imports and Exports of European Countries.

(Average data, calculated from the returns of the last five years, whenever available.)

Countries.	Quantities in Tons.		Values in £ Sterling.	
	Imports.	Exports.	Imports.	Exports.
Great Britain and Ireland	9,290,000	—	22,190,000	—
Germany	4,600,000	—	14,820,000	—
France	1,230,000	—	3,050,000	—
Belgium	1,020,000	—	4,100,000	—
Denmark	470,000	—	1,250,000	—
Italy	420,000	—	1,250,000	—
Spain	210,000	—	1,180,000	—
Holland	180,000	—	720,000	—
Switzerland	170,000		590,000	—
Portugal	60,000	—	200,000	—
Bulgaria	50,000	—	50,000	—
Greece	35,000	—	130,000	—
Servia	15,000	—	15,000	—
Roumania	—	60,000	—	180,000
Norway	—	1,040,000	—	1,870,000
Austria-Hungary with Bosnia and Herzegovina.	—	3,670,000	—	10,800,000
Sweden	—	4,460,000	—	7,930,000
Russia with Finland	—	5,900,000	—	8,900,000
Total	17,750,000	15,130,000	50,445,000	29,680,000
Net Imports	2,620,000	—	20,765,000	—

It will be observed that the following countries import (net) timber in a descending scale:—Great Britain and Ireland, Germany, France, Belgium, Denmark, Italy, Spain, Holland, Switzerland, Portugal, Bulgaria, Greece and Servia. The exporting countries are Russia (with Finland), Sweden, Austria-Hungary (with Bosnia and Herzegovina), Norway and Roumania. There is a deficiency of 2,620,000 tons for the whole of Europe.

Of the importing countries the first four demand special attention.

Great Britain and Ireland.

Table III.

Showing the Mean Annual Imports of Timber into Great Britain and Ireland.

Period.	Mean Annual Imports in Tons.
1864	3,396,000
1864–68	3,528,000
1869–73	4,459,000
1874–78	5,844,000
1879–83	5,789,000
1890–94	7,628,000
1895–99	9,290,000
1899 only	10,008,000

Mean annual increase of Imports during 35 years, 189,000 tons. Large and continuous as this increase is, it must be pointed out that the imports have risen very rapidly of late years, as the following figures will show:—

—	Tons.	Value.
		£.
Mean annual net imports, 1895-99	9,290,000	22,190,000
„ 1890-94	7,628,000	17,595,000
Mean annual increase	332,000	919,000
Mean annual increase in per cent. of imports.	4·4%	5·2%

These percentages show that the value has risen more rapidly than the tonnage; in other words, that the mean price per ton has increased by 18 per cent. in the course of five years. In order to probe this question further, I have calculated the average prices of all coniferous timber imported during the years 1895-99, obtaining the following results:—

Average Price per Ton of Coniferous Timber Imported

	£.	s.	d.
1895	1	17	7
1896	1	19	10
1897	2	2	2
1898	2	2	7
1899	2	3	2

These data indicate a slow but steady rise in prices equal to 15 per cent. in five years.

For the purpose of showing where all this timber comes from, I attach the following table.

Appendix II.

TABLE IV.

Giving details of the Timber imported into Great Britain and Ireland, during the Year 1899.

Country whence imported.	Quantity in Loads.								Value in Pounds Sterling.							
	Fir, hewn and sawn.	Oak, hewn and staves.	Teak.	Mahogany.	Other furniture and fancy woods.	House frames, fittings, &c.	Miscellaneous.	Total.	Fir, hewn and sawn.	Oak, hewn and staves.	Teak.	Mahogany.	Other furniture and fancy woods.	House frames, fittings, &c.	Miscellaneous.	Total.
British Possessions:																
Dominion of Canada	1,767,531	25,546	—	—	9,200	15,398	79,361	1,897,036	4,373,002	141,336	—	—	50,383	61,594	258,447	4,844,762
Newfoundland	62,299	—	—	—	—	—	—	62,299	88,350	—	—	—	—	—	—	88,350
West Indian Islands, Honduras, Guiana	—	—	—	14,455	4,315	—	3,001	21,771	—	—	—	131,392	30,527	—	19,081	181,000
West Coast of Africa and Cape Colony	—	—	—	26,782	1,833	—	—	28,615	—	—	—	256,037	15,042	—	—	271,079
East India and Straits Settlements	—	—	51,649	—	4,989	1,592	—	58,230	—	—	625,946	—	38,486	6,369	—	670,801
Australasia	5,782	—	—	—	131,894	212	—	137,888	29,538	—	—	—	544,894	846	—	575,278
Other British Possessions	4,320	24	12	363	185	555	4,093	9,552	4,320	139	150	2,988	1,240	2,221	4,630	15,688
Total British Possessions	1,839,932	25,570	51,661	41,600	152,416	17,757	86,455	2,215,391	4,495,210	141,475	626,096	390,417	680,572	71,030	282,158	6,686,958
Foreign Countries:																
Russia	2,141,800	51,676	—	—	1,354	4,805	42,293	2,241,928	4,783,879	239,461	—	—	18,437	19,220	79,751	5,140,748
Sweden	2,322,613	10,423	—	—	—	37,025	25,538	2,395,599	5,008,719	27,354	—	—	—	148,101	53,890	5,238,064
Norway	826,377	24,058	—	—	—	1,665	11,027	863,127	1,790,940	64,171	—	—	—	6,658	31,389	1,893,158
Denmark	2,466	—	818	—	—	1,878	—	5,162	4,122		10,415	—	—	7,511	—	22,048
Germany	309,580	44,972	—	4,736	2,915	34,146	6,852	403,201	741,002	332,291	—	38,478	24,611	136,583	17,927	1,290,892
Holland	295	385	101	—	1,450	28,286	8,194	38,711	1,305	3,206	1,120	—	9,597	113,144	38,016	166,388
Belgium	10	648	—	—	922	33,859	—	35,439	41	3,460	—	—	11,089	135,437	—	150,027
France	771,673	200	58	834	2,209	36,239	13,940	825,213	605,423	1,232	695	8,634	34,213	144,958	39,598	834,753
Spain and Portugal	49,314	—	—	—	—	—	—	49,314	38,889	—	—	—	—	—	—	38,889
Italy	—	—	—	—	242	615	—	857	—	—	—	—	2,193	2,640	—	4,653
Austria	—	9,882	—	—	—	1,062	—	10,944	—	99,198	—	—	—	4,248	—	103,446
Turkey and Greece	—	—	—	—	618	—	—	618	—	—	—	—	10,536	—	—	10,536
West Coast of Africa	—	—	—	6,687	409	—	—	7,096	—	—	—	66,639	2,460	—	—	69,099
Egypt	—	—	—	—	—	820	—	820	—	—	—	—	—	3,278	—	3,278
United States of America	540,119	128,608	—	9,693	71,973	162,086	79,290	991,769	1,532,116	705,519	—	102,219	520,851	648,346	361,008	3,870,059
West Indies, Mexico, Central, and South America	—	—	—	8,543	3,480	—	—	12,023	—	—	—	78,763	27,140	—	—	105,903
Other Foreign Countries	474	303	1,292	942	1,484	1,113	1,684	7,292	2,014	1,893	15,975	8,799	7,672	4,451	7,285	48,089
Total Foreign Countries	6,964,721	271,215	2,269	31,435	87,056	343,599	188,818	7,889,113	14,508,450	1,477,785	28,205	303,532	668,799	1,374,395	628,864	18,990,030
Grand Total	8,804,653	296,785	53,930	73,035	239,472	361,356	275,273	10,104,504	19,003,660	1,619,260	654,301	693,949	1,349,371	1,445,425	911,022	25,676,988
Exports	—	—	—	—	—	—	—	97,000	—	—	—	—	—	—	—	486,530
Net Imports	—	—	—	—	—	—	—	10,007,504	—	—	—	—	—	—	—	25,190,458

Table V.

Showing the Amount of Timber Imported in 1899.

	Per Cent of the Total Quantity.
Coniferous timber	87
Oak	3
Teak	·5
Mahogany	·7
Other furniture woods	2·4
House and door frames, &c.	3·6
Miscellaneous timber	2·8
Total	100·0

GERMANY.

Table VI.

Showing the Mean Annual Net Imports of Timber into Germany.

Period.	Mean Annual Net Imports in Tons.
1842-64	13,000
1865-69	913,000
1870-74	1,992,000
1875-79	1,692,000
1880-84	1.186,000
1885-89	2,075,000
1890-94	2,796,000
1895-99	3,200,000
1899 only	4,600,000

Mean annual increase during 35 years	131,000 tons.
Mean annual increase during the last 10 years	167,000 „
Value of the net imports in 1899	£14,820,000

The gross imports of timber into Germany in 1898 came from the following countries:—

From Austria-Hungary	1,883,000 tons.
„ Russia	1,831,000 „
„ Sweden and Norway	570,000 „
„ North America	262,000 „
Total gross imports	4,546,000 „

Of these quantities about 13 per cent. were hard woods and 87 per cent. coniferous timbers.

The following additional information may prove interesting:—

Annual production of timber in the German forests		15,000,000 tons.
Ditto firewood		23,000,000 „
Total timber and firewood		38,000,000 „
	£	£
Annual gross receipts from forests	21,500,000	
Annual costs for staff, labour, &c.	8,600,000	
Annual net receipts		12,900,000

About 1,000,000 people live by work done in the forests, and about 3,000,000 people by work connected with forest industries.

FRANCE.

The following data show the mean annual net imports of timber into France:—

Table VII.

Showing the Net Imports of Timber into France.

Period.	Value of Net Imports in £.
1865	4,640,000
1865-69	5,584,000
70-74	4,249,000
75-79	6,588,000
80-84	7,828,000
85-89	5,189,000
90-94	4,493,000
95-99	4,032,000
1899 only	4,053,000

The net imports have fluctuated, but there has practically been no increase during the last 35 years. The mean annual quantity imported during the last five years amounts to 1,230,000 tons. The imports come from Austria-Hungary, Sweden, Norway, Germany, Russia, North America, and Switzerland. The production of the French forests is given as follows:—

Timber	4,200,000 tons.
Firewood	14,000,000 „
Total production	18,200,000 „

The excessive proportion of firewood is due to the preponderance of coppice woods, and coppice with standards.

BELGIUM.

	Tons.	Value.
Net imports in 1898	1,020,000	4,100,000
Mean annual increase in net imports since 1865	22,000	
Mean annual increase during the last ten years	44,000	
Do. in 1899	80,000	

OTHER IMPORTING COUNTRIES.

The increase in other European countries is comparatively small. The net imports of Switzerland have during the last 10 years increased by about 17,000 tons a year, and those of Denmark by 20,000 tons. In all other countries together, the net increase may be placed at about 20,000 tons a year, or a total of 57,000 tons.

SUMMARY OF ALL IMPORTING COUNTRIES.

The total annual increase in net imports of all European countries of late years stands as follows:—

	Tons.
Great Britain and Ireland	332,000
Germany	167,000
Belgium	44,000
Other European countries, say	57,000
Total annual increase	600,000

If the same rate of increase lasts for another 10 years, an additional 6,000,000 tons will be required in 1910.

It will be useful to see what the present total consumption in the four principal importing countries is. The following statement shows this:—

Table VIII.

Showing the Annual Consumption of Timber in the Four Principal Importing Countries of Europe.

Countries.	Home Production of Timber in Tons.	Net Imports in Tons.	Total Consumption in Tons.	Number of Cubic Feet consumed per head of population.
Great Britain and Ireland	2,000,000	9,290,000	11,290,000	14
Germany	15,000,000	4,600,000	19,600,000	18
Belgium	600,000	1,020,000	1,620,000	12
France	4,200,000	1,230,000	5,430,000	7
Total	21,800,000	16,140,000	37,940,000	13

These data are based on reliable information, with the exception of the home production in Great Britain and Ireland, which has been estimated from the area of the forests and the yield of hedgerows, parks, etc. Considering that the consumption of timber in Britain has, during the last 20 years, *increased at more than twice the rate of the increase in population*, and that a similar process is going on in Germany and Belgium, I do not doubt for a moment that the consumption in the above four countries will in a few years have risen to 20 cubic feet per head of population.

I shall now proceed to deal with the exporting European countries :—

ROUMANIA.

Roumania has only about one acre of forest for every head of population. It has exported lately about 60,000 tons of timber annually. Even if this quantity should, in the immediate future, be somewhat increased, the rise, if any, will be so small that we can neglect it.

NORWAY.

	Tons.	Value.
Present annual net export	1,040,000	£1,870,000

Of late the major part of the exports went to Britain, France, Belgium, Holland, and to Germany.

The exports have not increased during the last 10 years; on the contrary, they have slightly fallen. Of the total forest area, 17,000.000 acres, only 12 per cent., or 2,040,000 acres, are State forests, and 500,000 acres Corporation forests. The remaining 14,460,000 acres are private forests, which are worked without any legal interference on the part of the State. The manufacture of paper pulp has assumed great dimensions, requiring annually already 1,400,000 tons of timber. A considerable portion of the forests is situated at a high altitude where growth is slow. All authorities are agreed that the Norwegian forests as a whole have been considerably over-worked, and that a decided falling off in the export must set in almost immediately.

AUSTRIA-HUNGARY, INCLUDING BOSNIA AND HERZEGOVINA.

	Tons.	Value.
Present annual net export	3,670,000	£10,800,000

The exports have been developed since the year 1855; they have increased during the last 10 years by 158,000 tons a year, which is equal to about 7 per cent. Of the exports :—

	Per cent.
Germany received in 1897	56
Italy " "	18
Russia and the Balkan received in 1897	10
France received in 1897	6
Switzerland received in 1897	3
Other countries received in 1897	7
Total	100

The following data show the distribution of the forest area according to proprietorship :—

	State Forests. Acres.	Other Forests. Acres.	Total Acres.
Bosnia and Herzegovina	4,753,000	2,037,000	6,790,000
Hungary	3,587,000	18,833,000	22,420,000
Austria proper	1,679,000	22,311,000	22,990,000
Total	10,019,000	43,181,000	53,200,000

Taking the three countries together, the average forest area per head of population comes to 1·6 acres. Of this ·3 of an acre is State forest and 1·3 acres private forest. The annual production of timber in these forests, of the class now exported, has been estimated at 16,000,000 tons, which is equal to 18 cubic feet per head of population, or just about the annual consumption in Germany. Taking into consideration the increase of population and the development of industries which has lately set in, the time does not seem far off when the Austrian Empire will require all the timber which her forests produce. But this is not all. Bosnia and Herzegovina, no doubt, have still considerable surplus stocks, but the forests of Hungary have been considerably overworked. Even as regards the State forests in that part of the monarchy, the Director-General of the Forests has publicly stated that the standing crop of timber is some 30 per cent. below the normal quantity, or the amount which should be present to permit of a permanent supply like that lately taken out of the forests. The condition in the private forests is still worse, so that Hungary, at any rate, must reduce its cuttings. Again, of the forests in Austria proper, a considerable part of the area is situated above an elevation of 3,000 feet, so that their annual growth is small. Even now an agitation is going on in Austria for the imposition of an export duty on raw timber, so as to check it. More than half the quantity of timber exported goes to Germany, and the opinion has been expressed that that country will soon have to look elsewhere for sources of supply to meet the increasing demand for timber in its industries. In short, Austria-Hungary is not likely to remain an exporting country for more than a limited number of years. This means that Germany must more and more compete with Britain in the Baltic timber trade, thus not only reducing the supplies available for Britain and other countries, but also considerably raising prices.

SWEDEN.

	Tons.	Value.
Present annual net exports	4,460,000	£7,930,000

The exports have just about doubled during the last thirty years; the average annual increase during the last ten years has been equal to 76,000 tons, or about at the rate of 2 per cent. The timber goes mostly to Britain, and next to France, Germany, Holland, Denmark, Belgium, Spain, and elsewhere. Sweden has a forest area of 48,000,000 acres, of which 12,000,000 are State forests. The latter have been taken fairly under systematic management. A considerable portion of the Swedish forests are situated far north, and their growth is very slow, giving only a small annual increment. In the more accessible areas it has already been necessary to prohibit the cutting of trees of less than eight inches in diameter at five feet from the ground, and a similar prohibition may soon become necessary in other areas. The manufacture of paper pulp and cellulose is rapidly increasing, and it is estimated that at present about 1,000,000 tons of coniferous timber are annually consumed by this industry, which is rapidly growing. Nevertheless, it is probable that the present out-turn may be maintained, and even somewhat increased, but by no means to such an extent as to make up for the prospective falling away of the exports from Norway and Austria-Hungary.

RUSSIA, INCLUDING FINLAND.

	Tons.	Value
Present annual net exports	5,900,000	£8,900,000

Thirty-five years ago the net exports amounted to about one-fourth, so that the mean annual increase comes to about 126,000 tons. About two-fifths of the exports come from Finland, and three-fifths from Russia proper. Of the timber, 38 per cent. go to Britain, 32 per cent. to Germany, and the remaining 30 per cent. to France, Belgium, Holland, and other countries.

The distribution of the forest area, according to proprietorship, appears to be as follows :—

	State Forests.	Private Forests.	Total.
	Acres.	Acres.	Acres.
Finland	20,000,000	30,000,000	50,000,000
Russia proper	294,000,000	172,000,000	466,000,000
Total	314,000,000	202,000,000	516,000,000

The average area of forest land per head of population is just under 6 acres.

These are large areas, and at first sight it would appear that they are sufficient to supply any deficit that may appear elsewhere. In reality, however, matters are far less roseate. In the first place, the forest area includes enormous swampy tracts which produce little or no timber; then there are very extensive areas, which are thinly stocked with alder, birch, poplar, hornbeam, etc.; so that the area of really important forests is only a fraction of that given above. Moreover, it is very unevenly distributed over the empire. There are enormous tracts with no forests at all. In and about the Caucasus we find considerable forests, but the bulk of the impor-

Appendix H.

tant areas are in the north of the empire—that is to say, in Finland, and in the adjoining provinces eastwards. It is from these parts that the coniferous timber is exported, and for all practical purposes these forests are of special interest. Unfortunately, information regarding their yield capacity in the future differs very considerably, and it is not easy to arrive at a final conclusion on the question. There can be no doubt about a few points. The population of European Russia, including Finland, is now estimated at 105,000,000, and it has, of late, been increasing very rapidly. The consumption of timber and firewood in a northern country like Russia is naturally very great; indeed, in many parts of the Empire it has been estimated at three tons per head of population. If this is so, by far the greater part of the forests is required for home consumption.

Professor Mayr, of Munich, has lately spent some time in Russia, and given us an estimate of their yield capacity. He divided the productive forests of Northern Russia into three regions—the western, the central, and eastern. The data which he has collected indicate that the growing stock in the western region is about 60 per cent. below the normal amount, that of the central region about 30 per cent., and that the eastern region is still normally stocked. This shows that, in the more accessible areas, production has not kept pace with utilisation.

On the whole I cannot find any proof that Russia will be able to keep up her present export for any length of time, not to speak of a further increase. Anyhow, there cannot be any doubt whatsoever that the rate at which the timber can be delivered on board ship must rise in the same degree as the distance of transport from the forests to the sea coast increases.

If we now sum up what has been said about European countries, it is clear that the exports from Norway have already commenced to fall off; that those of Austria-Hungary must soon follow in the same way; that Sweden may increase her exports to a moderate extent; and that Russia is at present certainly a doubtful factor. Under these circumstances the present deficiency of 2,620,000 tons is sure to increase, because the European sources of supply are not likely to meet an additional 600,000 tons required annually.

I have endeavoured to bring together the data of net exports of as many non-European countries as possible; nevertheless, the table which now follows is incomplete :

Table IX.

Showing the Imports and Exports of Non-European Countries.

Countries	Net Imports, Tons.	Net Exports, Tons.
South America	330,000	—
Egypt	200,000	—
Australasia	160,000	—
Cape of Good Hope	150,000	—
Natal	50,000	—
China	50,000	—
Mauritius	20,000	—
Ceylon	10,000	—
Japan	5,000	—
West India, Mexico, New Guinea, Honduras	—	13,000
West Coast of Africa	—	28,000
India	—	55,000
United States of America	—	1,020,000
Dominion of Canada and Newfoundland	—	2,144,000
Total	975,000	3,260,000
Net Export	—	2,285,000

This table shows a surplus of exports amounting to 2,285,000 tons. Compared with the deficit of European countries (2,620,000 tons), a deficiency of 335,000 tons will be noticed. It is due to the incompleteness of Table IX., such countries as Siam, Java, Madagascar, and others not being represented. Besides, in some cases I had to estimate the tonnage from the values.

Dealing first with the importing countries, it may be said that South America is likely to continue its imports, which consist of light coniferous woods. Egypt has no timber of its own, and the imports are sure to rise with the further development of the country. As regards Australasia, it should be stated that New South Wales, Victoria, and South Australia have of late imported timber in considerable quantity, whereas Western Australia, Tasmania, Queensland, and New Zealand have exported, there being on the whole a balance of 160,000 tons annually against Australasia. The exports from Western Australia have quite lately considerably increased, and they are likely to increase further. At the same time these timbers are hard woods, of which a certain quantity will find a market in Europe, but they will never make up for a decrease in the light coniferous woods, apart from the fact that, up to date, it has not been possible to lay them down in European ports under £4 a ton, or about double what the coniferous woods cost us.

The imports into the Cape of Good Hope have steadily increased of late, and they are likely to increase further, owing to the political changes which have lately taken place, and the more rapid development of the mining industry, once the war has been brought to a conclusion. Natal is similarly situated.

China is a country which demands our special attention. So far her imports have been small, but she has little timber of her own, considering the extent and population of this empire, and the imports must increase in the same degree as her commerce develops. It is, perhaps, impossible to say when the great rise will commence, but all the signs of the times seem to indicate that it will be soon. Once the country has been opened to foreign commerce and industries, China will require, owing to her size, enormous quantities of timber, which will come from the western ports of North America and perhaps from Asiatic Russia.

Japan has made great efforts to introduce systematic management into her forests, but she figures in our table already with a small net import. With the rapid development of industries Japan will require more and more timber, which her own forests will not be able to furnish.

Taking the importing non-European countries together, there can be no doubt whatever that their net imports will increase as time goes on.

The exporting non-European countries are those around the Caribbean Sea, the West Coast of Africa, India, the United States of America, and Canada. The first of these export mahogany and other furniture wood, but they import so much lumber that their net exports dwindle down to 13,000 tons a year. The West Coast of Africa has exported 28,000 tons, consisting also of mahogany and other hard woods, valued at more than £9 a ton. Whether that export will continue or not it is difficult to say, but under any circumstances these timbers are so expensive that they do not affect the question here under discussion. British India sends teak and some furniture woods; more it cannot do, having, with a forest area which may be placed at 140,000,000 acres, to supply a home population of some 250,000,000 people.

There remain, then, the United States of America and Canada. Before dealing with these countries I propose to devote a few minutes to enquire whether other sources are available. The only countries which we need at all consider are Asiatic Russia, Central Africa, and South America. The first of these three is a big country; it contains extensive areas which are classed as woodlands; but a great part of the country is practically situated beyond the limit of profitable tree growth, while other extensive areas are plains without forest. Supposing, however, that there is a surplus of production for export, the cost of transport would be practically prohibitive. The outlets by water are towards the North Polar sea, involving exceedingly difficult navigation, and if transported by land towards the west, the distance would be very great. It is, however, not impossible that any surplus timber might hereafter go towards China.

Africa has a belt of wooded country along or near the west coast which furnishes us, as already stated, with a limited quantity of valuable hard woods, but from all I can learn, the great central forest will, as regards a source of timber supply for Europe, remain without much value. A brisk trade in caoutchouc has sprung up, but the timbers are not of the kind which

Appendix II.

we require in Europe in large quantities, apart from the cost of transport to the coast. Matters are similar in South America. Vast forests are said to exist in Brazil and in parts of Argentina, but, as far as we know at present, they contain only hard woods of any commercial value, of which we have as yet a sufficient supply at lower rates nearer home. At any rate, the cost of transport and labour seems to be so high that Argentina, at any rate, prefers importing its timber from North America and the Baltic, rather than get it from her own forests. Possibly the forest wealth of South America may hereafter play a part in the supply of timber, but I believe that that time is far distant.

I now come to the most important part of my subject, namely, the position which the United States of America and Canada take in the timber supply of the world.

THE UNITED STATES OF AMERICA.

It will be remembered that I have put down the net export of late years as equal to 1,020,000 tons. This is an estimate derived from the values. The latest return issued by the Bureau of Statistics, Treasury Department, Washington, entitled "The Lumber Trade of the United States," forms part of the papers published in connection with the recent Census. It contains the following information:—

Table X.

Imports and Exports of Wood and Manufactures of Wood compared.

Period.	Imports. Value in £.	Exports. Value in £.	Net Exports. Value in £.
1886-88 - - - -	2,862,000	4,224,000	1,362,000
1889-91 - - - -	3,520,000	5,430,000	1,910,000
1892-94 - - -	4,077,000	5,345,000	1,268,000
1895-97 - - - -	3,928,000	6,579,000	2,651,000
1898-1900 - - -	3,264,000	8,640,000	5,376,000
Average of 15 years -	3,490,000	6,043,000	2,553,000

This table gives the value of timber and manufactures of wood. Unfortunately, separate returns for timber only are not available. It will no doubt cause surprise to see that more than half the exports were made good again by imports, chiefly from Canada. There has been a falling off in imports during the last three years, due to Customs differences between the two countries. The sudden increase in the exports during the last five or six years is said (in the Report) to be "the consequence of the high appreciation which European communities place on their timber resources, and the increased dependence on the American lumber supply." It is added that "during the last year much English and German capital has gone into American timber lands." This explanation is correct in a way, but I should express it somewhat as follows:—The timber requirements in Europe, especially in Britain, Germany, and Belgium, have so rapidly increased of late years that the European sources—that is to say, Russia, Sweden, and Austria-Hungary—can no longer meet them; hence the increased demand on America. This, more than anything else, proves to me that any increase in the exports from Russia and Sweden will be limited.

The question then arises, can the United States meet this increased demand for any length of time? I am quite sure that this will not be possible, as the following data will show:—

The total wooded area is given as 700,500,000 acres, being equal to 37 per cent. of the total area, and giving an area of nine acres per head of population. The timber standing on this immense area has been estimated, and it is given by one of the foremost authorities as equal to 3,450,000,000 tons (reckoning a ton equal to 400 feet board measure), which gives not quite 5 tons per acre all round. In France, Germany, and Austria this would be called about one tenth of the average full stocking; hence the United States forests would, as regards their yield capacity, for the next half century be equal to about 70,000,000 acres in France, Germany, or Austria.

The lumber cut in 1890 is given as equal to 63,000,000 tons, and it was calculated that the existing stand of timber would last for about 50 years. For the year 1899 the cut is given as follows:—

Coniferous timber - - -	75,000,000 tons.
Oaks and other hard woods -	25,000,000 „
Total - -	100,000,000 tons.

At this rate the available stand would last only about 34 years. If during the next 10 years the annual cut increases at the same rate as in the past 10 years, it will amount to 137,000,000 tons, and the remaining stand will be consumed in about 25 years. Again, the annual production has been estimated at 75,000,000 tons, so that the present annual consumption exceeds it by 33 per cent. It is stated that besides the cuttings large quantities of timber are destroyed annually by fire and other sources of loss, so that it is altogether probable that the annual growth is considerably less than the annual destruction. This means that the United States consume annually not only the legitimate growth or increment, but also a portion of their capital, a process which must inevitably lead to bankruptcy if it is not stopped at an early date. The seriousness of the position has fortunately been recognised, and efforts are being made to introduce more conservative lumbering, and to protect the forests against the ravages by fire and grazing.

First an enlightened man here and another there drew attention to the matter. Soon numerous people took up the cry, societies were formed, which collected information and made it available for the general public. The State Governments next took steps to prevent destruction by fire, and to save certain areas from ruin by converting them into State parks, etc. The Federal Government established a Forestry Division, whose duty was in the first instance to collect information. Some 12 years ago a wealthy young American, Mr. Gifford Pinchot, came to study forestry in Germany and France, and he has been followed by half a dozen others, all of whom have made their studies under the enlightened guidance of my old friend, Sir D. Brandis. Soon after Mr. Pinchot's return to America, Mr. George Vanderbilt bought a forest estate of 100,000 acres, and put it under systematic management, first by Mr. Gifford Pinchot, and then by a distinguished young German forest officer, Dr. Schenck, with the main object of showing that forests can be worked profitably. About two years ago Dr. Schenck started a forest school in connection with Mr. Vanderbilt's estate, and last summer I had the pleasure of conducting six of his pupils through some of the most interesting Bavarian forests, these young men having come to learn how forest matters are managed in the old country. But this is only one instance. At the present moment forest faculties exist at three American universities. One of these has been endowed by the State of New York, who have assigned 30,000 acres of forest for the practical instruction of the students. The State of New York has spent £450,000, since 1897, on the purchase of forest lands, the total area so far required being 1,000,000 acres.

At another university a faculty of forestry has been endowed by Mr. Gifford Pinchot and his family, who have presented the university with the sum of £30,000 for the purpose. But over and above this, instruction in forestry is now given at about 40 other educational establishments in the States.

Last, but not least, the Federal Government has inaugurated a systematic forest policy. An area of 41,000,000 acres have, by presidential proclamation, been declared "reservations," and a staff of nine superintendents, 39 supervisors, and 350 forest rangers have been appointed. It is said that the patrolling of the reserved forests by the rangers has to a marked degree reduced the number of fires, has excluded timber trespassers, and enforced instructions regulating the subject of sheep-grazing, timber-cutting, and sales. All this is a small beginning, but it is a promising instalment, and if the Federal Government persists in its policy, great benefits for the people of the United States, the lumbering and wood-using industries will result, while the fear of a prospective timber famine, which has laid hold of the mind of many enlightened Americans, may yet be avoided. At any rate, it seems clear that the people of the United States are determined to preserve and adequately manage a sufficient area of forests for the benefit, not only of the present generation, but for their children and grandchildren. Surely these are facts worth pondering over!

The Dominion of Canada.

	Tons.
Mean annual net export of late years - - - - - - -	2,144,000

The value of the exports during the last 30 years have been as follows:—

Table XI.

Showing the Value of the Exports of Timber from the Dominion of Canada.

Period.	Annual Export in £.				In per Cent.		
	To Britain.	To the United States.	To other Countries.	Total.	To Britain.	To the United States.	To other Countries.
1870–79 - -	2,627,000	1,481,000	428,000	4,536,000	58	33	9
1880–89 - -	2,212,000	1,876,000	389,000	4,477,000	49	42	9
1890–99 - -	2,493,000	2,427,000	327,000	5,247,000	48	46	6

Of the exports, 94 per cent. are coniferous timbers, and 6 per cent. hard woods. The increase during these 30 years, according to value, has been at the rate of about half a per cent. a year.

The price per ton has, however, risen since 1870. Taking white pine squared logs, for instance, the average prices were as follows:—

Period.	Average Price per Ton in Shillings.
1870–79 - - - - - - -	32
1880–89 - - - - - - -	47
1890–99 - - - - - - -	61

The rise in the price of other timber has been much smaller, but sufficient to show that the total quantity of timber exported is now less than it was 30 years ago.

Canada has not been able to meet the increasing demand in Europe. The above figures, moreover, show that whereas the exports to Britain have fallen, those to the United States have increased, so that practically the two countries now take equal quantities. A moderate reaction has, however, taken place during the last three years, owing to differences between Canada and the United States regarding the duty to be paid on timber. The exports are chiefly represented by raw material. On the other hand, Canada imports worked-up timber, chiefly from the United States, valued as follows:—

	£.
Period 1885–89, mean annual value - -	497,000
" 1890–94, " " - -	548,000
" 1895–99, " " - -	639,000

These imports have steadily risen.

It is of the highest importance to inquire into the yield capacity of the Canadian forests. The following table shows their areas:—

Table XII.

Showing the area of Forest in the Dominion of Canada.

Provinces.	Area of Woodlands in Acre.	Percentage of Woodlands to Total Area.	Area per Head of Population in Acres.
Prince Edward's Island	510,000	40	5
Nova Scotia - -	4,137,000	31	9
New Brunswick - -	9,450,000	53	29
Ontario - - -	65,356,000	46	31
Quebec - - -	74,573,000	51	50
Manitoba - - -	16,401,000	40	107
British Columbia -	182,755,000	75	1,885
Territories - - -	446,049,000	20	4,566
Total - - -	799,231,000	38	165

In round figures, Canada has 800,000,000 acres of land classed as forests, but it has been stated by the Chief Inspector of Timber and Forestry for Canada that only one-third of the area, or 266,000,000 acres, can be considered as timber lands, the rest being covered with small growth, of some use locally, but of little, if any, merchantable value. The area of timber lands and the quota per head of population are so great, that no failing of future supplies should be possible. Nevertheless, Mr. George Johnson, the statistician of the Dominion, gives anything but a flourishing account of the state of affairs. The white pine used to be the principal item in the exports. It has now fallen to one-fifth of the amount of 30 years ago, spruce having gradually taken its place. Of the latter species, enormous quantities are said to exist, but cutting has developed so rapidly of late, that, as regards Ontario, it is stated, "its increasing use for the manufacture of wood pulp, threatens serious inroads upon this valuable tree." The third of the most important trees, the Douglas fir, has its principal home in British Columbia; it appears in commerce as Oregon pine.

From a commercial point of view the forests of Canada must be divided into two parts: the eastern, which supplies chiefly the United States and Europe, and the western, which exports also to the United States, to Asia, Australia, and other countries. As already stated, the eastern half has not responded to the extra requirements of Europe, and I doubt whether Canada will be able to do so in the future, unless decided steps are taken at once to start thorough protection and systematic management on selected areas, or, as they may be called, reserved State forests. Mr. Johnson says:—

"A large portion of the (eastern) forests has been deviled, which means that all good trees have been cut out by the lumber men for marketable timber. The careless torch has lighted fires like the Miramichi fire, which swept with fierce energy over an area of more than three million acres, leaving blackened giant pines to be a reminder, for more than half a century, of the immense destruction there and then caused. Vast areas have suffered from fire so severely, that in many places the soil has been burned off to the very rock; and a century's disintegrating force will have to act upon the rock, before there can be soil enough created for practical uses."

Again, Mr. Edwards said, in 1893, in the Canadian Parliament:—

"It is safe to say, and I am sure that every lumberman in this house will bear me out in that statement, that ten times the amount of forest wealth has been destroyed in Canada through forest fires than has been cut by the lumbermen."

The cuttings in 1893 were estimated to amount to 40,000,000 tons, and if Mr. Edwards is right, the annual destruction would amount to 400,000,000 tons, or considerably more than the existing timber area produces. This is not a nice state of things to behold. Since then the forest question has attracted more and more attention. Measures have been taken to introduce a more economical system of lumbering and to check fires. But what can a small establishment do over such vast areas?

Appendix II.

Taking Quebec, for instance, each fire district comprised, three years ago, an area of three and a half million acres of wood lands. This is not the way to proceed if real success is to be achieved. The Governments of the several provinces must make up their minds to select and demarcate a sufficient proportion of the area as reserved State forests, and gradually bring them under complete control, and a rational and systematic management. Considering the large areas available to choose from, there should be no difficulty in permanently reserving an area of 100,000,000 acres, which would still leave 700,000,000 acres open for more or less unrestricted lumbering, extension of cultivation, etc. The annual revenue derived from the Canadian forests amounts, at least, to some £700,000. If half that sum were devoted to the above purpose, substantial progress could at once be made to secure not only the present, but an increased turn-out for any length of time, leading ultimately to a revenue tenfold, and more, the present amount, and securing a permanent supply of coniferous and other timber for the world.

As to the large stocks of timber in Columbia any surplus over home requirements will all be taken by China, when once that immense empire has entered upon an era of development.

It has been stated in official publications that more than £20,000,000 have been invested in the Canadian lumber and sawmill industry, and that some £5,000,000 are paid annually in wages. Surely these are sums not to be trifled with apart from the fact that under a proper system of forest management they would be capable of developing in the course of time to two and three times the present amounts.

So far I have hardly touched upon a very important matter, the manufacture of paper stuff, or pulp and cellulose. There is some difficulty of getting at the actual quantities of timber consumed by that industry. Those used in importing countries, like Britain, Germany, France, and Belgium, are included in the data given for those countries. As regards exporting countries it is stated that—

		Tons.
Sweden uses now annually	-	1,000,000
Norway ,, ,, ,,	-	1,400,000
Finland ,, ,, ,,	-	200,000
Canada ,, ,, ,,	about	1,200,000
Total -	-	3,800,000

As regards the United States it should be stated that a portion of the pulp wood comes from Canada, but over and above this, the quantity derived from the State forests must be very great. For Maine alone the quantity is given as equal to 750,000 tons. I do not think that I shall be far out if I place the total annual consumption of pulp wood at some 7,000,000 to 8,000,000 tons.

In summing up now, it may be said that of hard woods there is as yet a large supply. If present sources of supply should fail, others, such as Central and South America and Africa, may be opened out. The rate per ton may rise, but the material will be forthcoming. It is altogether different as regards coniferous woods, the requirements of which amount to not less than 85 per cent. of the total. The only countries whence a further increase in the consumption of these woods can be obtained are Sweden, Russia, especially Finland, and Canada. As pointed out, Austria and the United States must cease to be exporting countries within a limited number of years. Sweden is likely to yield somewhat more in future, but the amount of the possible annual increase is not likely to be more than one or one and a half million tons. Great uncertainty exists as regards Russia. If her population increases, as statisticians have lately calculated, even her export of timber may cease, or at any rate be considerably reduced. Under these circumstances, the great stand-by for coniferous timber will be Canada, if the Government does not lose time in introducing a rational management of her forests.

The second part of my paper will be short. In it I propose to draw attention to a few lessons which may be learned from what I have said, as regards the British Empire as a whole, and these islands in particular. The following table shows the average annual net imports and exports of the principal parts of the Empire:—

Table XIII.

Showing the Net Imports and Exports of Timber into and from the British Empire.*

Countries.	Annual Average during the years 1890-94.		Annual Average during the years 1895-99.	
	Imports. Value in £.	Exports. Value in £.	Imports. Value in £.	Exports. Value in £.
Great Britain and Ireland -	17,595,000	—	22,190,000	—
New South Wales - -	467,000	—	311,000	—
Victoria - - - -	831,000	—	231,000	—
South Australia - - -	250,000	—	198,000	—
Ceylon - - - - -	—	22,000	21,000	—
Mauritius - - - -	41,000	—	37,000	—
Natal - - - - -	99,000	—	176,009	—
Cape of Good Hope - -	160,000	—	416,000	—
Jamaica - - - -	57,000	—	55,000	—
Barbadoes - - - -	65,000	—	33,000	—
Trinidad - - - -	41,000	—	40,000	—
British Guiana - - -	41,000	—	27,000	—
Queensland - - - -	—	11,000	—	5,000
Tasmania - - - -	—	39,000	—	29,000
Western Australia - -	—	114,000	—	77,000
New Zealand - - -	—	151,000	—	146,000
British India - - -	—	682,000	—	593,000
West Coast of Africa - -	—	22,000	—	70,000
British Honduras - - -	—	142,000	—	130,000
Dominion of Canada - -	—	4,470,000	—	4,835,000
Total - - -	19,647,000	5,653,000	23,735,000	5,885,000
Net Imports - - - -	13,994,000	—	17,850,000	—
Increase in 5 years - - - - - -			3,856,000	—
Average annual increase - - - - -			771,000	—
Average annual increase during previous 5 years (period 1885-89 compared with period 1890-94) - -			382,000	

* A few Colonies have been omitted for want of data.

These data are worthy of our most serious consideration. With all the forest wealth of our Colonies we import now every year timber valued at close on £18,000,000, and the sum has lately risen at the rate of £771,000 annually. Surely the time has come, or rather it came some time ago, for a more vigorous forest policy on sensible lines throughout the Empire. Let us strive to introduce systematic forest management, more particularly into Canada and Australasia. The question is, no doubt, beset by great difficulty, but where there is the will there is also a way. Above all, let the self-governing Colonies consider a little more seriously, than up to date, the magnificent example which has been set to them by India, where the preservation of the State forests has now been put on a safe basis for the everlasting benefit of the people of the country and the Indian exchequer.

But should we not begin by setting our house at home in order before we go and preach abroad? The imports into the United Kingdom in 1899 are valued at £25,000,000, and they have increased of late years at the rate of 332,000 tons, valued at £919,000 annually. I think I have said enough to show on how precarious a footing future supplies rest.

The price of timber is steadily, though slowly, rising, and 87 per cent. of the total imports consist of pine and fir timber, the sources of which are specially exposed to exhaustion. Whence are we to obtain the 9,000,000 or 10,000,000 tons of coniferous timber when the countries round the Baltic, and perhaps also Canada, have commenced to fail us? These are the timbers which form the very staff of life of our building trade, and a deficiency of supply in this direction must have the most serious effect upon the population of these islands. And all the time we have sufficient, and more, surplus land at home to produce all this timber without putting a single acre out of cultivation. There are 12,000,000 acres of waste land and 13,000,000 acres of mountain and heath land to choose from the necessary 6,000,000 or 7,000,000 acres. Surely £25,000,000 going out of the country every year, is money enough to take some trouble about. Only a few weeks ago "The Times" drew special attention to the fact that our imports greatly exceeded the exports, a circumstance which fills a good many people with misgivings. And here is an item valued at £25,000,000, which could be produced at home, going begging.

Whenever measures of extended afforestation have been urged, the reply has generally been that the British woodlands are maintained for other purposes and not for economic reasons, and that woodlands in these islands do not pay. As regards the first of these two arguments, very well, let it be so. I do not want to touch a single acre of the existing woods (though they could be so managed as to give a revenue, without interfering with shooting, etc.), let them continue to serve as game preserves and adornments of the landscape. What I do urge is the creation of *additional* woods on surplus lands to be managed on economic principles, for the production of timber and other forest produce. To make such a movement a success it is, however, necessary to dismiss once for all the idea that anybody can manage woodlands so that they may be financially successful. People must learn that successful forestry must be based on research at least as much as agriculture. At Coopers Hill we educate the forest officers required for India, and we have also trained three for Cape Colony, one for Ceylon, and one for Mauritius. But the study at Coopers Hill is so arranged as to meet the requirements of India, and the expenses connected with the course are necessarily high. The college belongs to the Government of India, which cannot be expected to provide for the education of forest experts who will either go to the Colonies or be employed in the United Kingdom.

Efforts have been made towards giving instruction in forestry at other places, as in Edinburgh; but what we require is at least one well equipped forestry faculty at a university, such equipment to include a suitable practical training ground. In addition, sylvicultural schools are wanted, where men of less pretensions may be educated to fill the posts of foresters on private estates of limited extent. I believe that landed proprietors would pick up the men trained at such schools to carry out the plans which experts have prepared for them.

The difficulty about extended afforestation in the United Kingdom lies in the fact that the waste lands available for planting are almost entirely private property, and that most of the proprietors are either unwilling or unable to invest money in an undertaking which will commence giving a return only after the lapse of a series of years. They prefer a present small rent from shooting to an increased income from forests hereafter. Let us hope that the Government and enlightened proprietors will succeed in overcoming the difficulty. It is, indeed, easy to show that millions of acres which now yield a grazing revenue of a few pence an acre, or shooting rents of perhaps eighteenpence a year, could be made to yield a net revenue, after allowing compound interest for all outlay, of ten shillings and more, if put under forest in a sensible and economic manner. With a view to inducing owners to plant, Government might help in various ways. *Advances for the purpose might be given, to be recovered in the shape of a sinking fund; afforested lands might be exempt from taxation for a number of years, that is to say, until the first thinnings commence; in other words, forests should be taxed according to the income which they yield, and not the area which they occupy.* In other cases, as in the congested districts of Ireland, and probably also in Scotland and Wales, if not in England, surplus lands might be acquired by the State and put under forest. Under the existing land laws the Congested Districts Board of Ireland purchases estates. After settling all unoccupied parts with the tenants, considerable areas of waste land remain over, which should be converted into State forests. This is a matter which I pressed upon the Government of Ireland 15 years ago. There are at least 2,000,000 acres of such land available in Ireland, and still larger areas in Scotland, not to speak of Wales and even England. By afforestation additional labour would be required in rural districts, and help to reduce the eagerness with which the younger part of the rural population now flock into the great cities, where only too many are destined to swell the large army of the unemployed.

(xii.) INSUFFICIENCY OF THE WORLD'S TIMBER SUPPLY.

BY M. MELARD, INSPECTOR OF FORESTS, FRANCE.

[*Transactions of the Royal Scottish Arboricultural Society, Vol. XVI., Part iii.*, 1901.]

But seven countries are at present able to supply large quantities of timber, viz., Austria-Hungary, Sweden, Norway, Finland, Russia, the United States, and Canada. Of these, the available surplus of Austria-Hungary, Russia, and the United States is seriously threatened by increase of population and industrial development, and that of Norway by abuse of the axe. The three remaining sources of supply are absolutely insufficient.

Wood production, in which time is the principal factor, obeys economic laws other than those which govern industrial or agricultural production; and an increased demand for wood, instead of inducing an increased production, tempts owners to realise the capital slowly accumulated by preceding generations.

The situation is full of peril, and the need of instructing public opinion is urgent. Wherever it is not too late, the destruction of forest must be stopped, either by legislation or by persuading landowners to cut no more than the annual production of the soil. Formerly it was held that private owners could not undertake the production of timber, because of the low rate of interest returned by a capital invested in high forest. But the customary interest on stable securities has now get below 3 per cent., and it is probable that standards over coppice will yield quite as much as this, without reckoning anything for the certain rise that must take place in the price of timber.

Forests should not be over-burdened with taxes. There are in France forests taxed up to 20 and 25 per cent. of the gross revenue, yet they receive no kind of public protection, and the owners have to employ private guards. The rapid destruction of certain forests in the United States has also been attributed to the same cause, taxes amounting to 5 or 6 per cent. of the sale value of the forest.

The State ought to be very liberal to forest-owners, by exempting them from taxation, by free distribution of seeds and seedlings, and by gratuitous technical advice. It should afforest tracts of waste land—of which there are thousands or millions of acres in western or southern Europe, and of which the agricultural possibilities have come to an end. Such afforestation should not merely be in the mountains, where it is rather a work of defence against the forces of nature, but in the plains, which can grow timber that cannot be obtained in the hills.

There is not a moment to be lost. Forest produce cannot be procured at a moment's notice. A century and more is required to produce sawyer's timber, and the timber famine will begin ere fifty years are past.

Appendix II.

(xiii.) The Forestry Exhibition at Paris and Some of its Lessons. By J. S. Gamble, C.I.E., F.R.S.

[*Transactions of the Royal Scottish Arboricultural Society, Vol. XVI., Part i.*, 1901.]

The exhibits of the French section were in two portions: first, that of the Forest Department, and second, those of private individuals and forest societies. In France, the National Department of Forestry is concerned only with the management, growth, and tending of the forests, and all produce is sold standing; hence, works of conversion and extraction, which are such a feature of forest work in Germany, Austria and Hungary, were but little represented. Sylvicultural work was, however, represented by copies of forest working plans, with the control books belonging to them; there were also several interesting exhibits to show the progress made in forest roads and forest works. Timber was represented by numerous wood specimens, and a large series illustrated the small forest industries and the local uses to which the products of the forests are put. The chief State exhibits were, however, those illustrating the steps taken in recent years to reclothe denuded mountain slopes, to regulate torrents, to prevent landslips, and to plant coast sands. In the last forty years the Government has reclaimed nearly 640 square miles of country, and spent about £2,500,000. The planting of mountain sides liable to denudation is of less importance in Britain than the fixation of shifting coast sands and dunes, such as on the coast of Moray. The most important work in this connection has been on the coast of the Bay of Biscay. This was commenced in 1779, and nearly completed in 1864; an area of 260 square miles having been reclaimed and afforested, almost all of it with the pinaster, at a cost of about £620,000.

The German Government also exhibited drawings, etc., showing the work done on the coast of the North Sea; the shifting dunes on nearly the whole north coast of Germany having now been afforested with Scots pine.

The Russian exhibits included a map, showing the area of forests in the Empire to be something under 1,000,000 square miles. Except in the Caucasus, much of the southern half of Russia is bare of forest; the forest area then increasing largely, until in the north, between the parallels of St. Petersburg and Archangel, the country is almost all wooded. Much of this forest area must be very far, not only from the coast, but even from navigable waterways or railways, and thus difficult to work with profit.

The Russian forests are chiefly spruce and Scots pine, but it is interesting to note that there are in places woods of nearly pure lime, worked for bast fibre, bark, boots, boxes, baskets, etc. The preparation of working plans for the Russian forests began in 1840, and most of the Government forests in the centre and south have been placed under systematic working, while considerable progress is being made in the huge areas of the north and Siberia. Much attention is paid to the economy of refuse material, and the utilisation of the less valuable trees, such as the manufacture of tar, resin, turpentine, acetate of lime, methylated spirit, tanning extract, etc. The manufacture of resin and turpentine from the Scots pine is on some provinces so important an industry that in 1898 these products were exported to a value of about £180,000. If such energy can be displayed in the proper management of forests in regions which, like those of northern Russia, are poorly supplied with means of transport, it ought to be possible to do more in Great Britain. We have in places large areas of pine forest, often of branching trees poor in capability of yielding timber, but which might be utilised, without the need of felling, as a source of supply of resin and turpentine.

The chief lesson brought out by these collections is that forestry requires not merely a smattering, but an intimate knowledge of several sciences. In such countries as Austria, Germany, Hungary, etc., a forest officer is bound to be a first-rate scientist; and in this country it is beginning to be admitted that scientific aptitude and a liking for science are requisites of the first importance. A really successful forest officer must at every hour apply scientific methods, and a love for science, to a correct appreciation of the phenomena which he comes across. In Scotland foresters are in most cases more or less born to the work, and their powers of observation of forest phenomena are developed by experience obtained at perhaps the most impressionable age; but, valuable as is the experience so gained, it is far more so when it can be rightly guided and directed by a scientific educational training. A liking for outdoor life must rank next in importance to the development of powers of accurate observation. It is therefore to be regretted that the recommendations made recently by the British Association, urging the importance of selecting candidates of scientific aptitude, have not been adopted. In France and other European countries the students for the special forest schools are mostly selected from among the most suitable at the agricultural colleges, so that before they begin their special training they are already grounded in science. In this country, with scientific degrees conferred at the universities, more especially Cambridge and Edinburgh, very little alteration would be necessary to ensure candidates who have already a good grounding in preliminary science.

Another lesson is the development of modern methods of utilisation of forest products. The wood-pulp industry, for instance, in Sweden, Norway, and Canada is valued by M. Mélard at £8,000,000; very little is produced in the United Kingdom. The chief tree used is the spruce, grown in close plantation, and cut at a comparatively early age, when capable of giving straight pieces, free from knots and branches, of 4in. to 8in. in diameter. In 1892 there were reckoned to be about 600 factories for paper-pulp, and 200 in Austria-Hungary, producing annually about 270,000 tons of pulp.

The United States and Canadian exhibits showed that the importance of having permanent forest reserved areas, and of treating these areas in the most scientific and economical manner, is being recognised. In the United States many large reserves have already been formed and placed under working plans. In Canada Mr. J. M. Macoun states that wise laws have been made by the provincial and federal Governments, having for their object the preservation of the forests, and the various Governments are taking steps towards the re-foresting of the denuded areas under their control. It appears, however, that steps have not yet been taken to set apart permanent forests, get together a professional staff, ascertain even roughly the amount of the capital stock, and restrict fellings to the amount which can be calculated as the permanent annual yield. It is to Canada and its forests, more than to any other country, that the world will have to look when the wood famine arrives; and it may be hoped that the lesson will attract the attention of the Government of the Dominion before it is too late.

What is wanted in this country is the institution of State reserved forests and a State Department. At present the Government estates are doubtless as well and as scientifically managed as present circumstances allow; but they are badly hampered by prescriptive rights, and by the common but erroneous idea of the public that a properly managed forest is one which has lost its beauty. If the British Government wished to possess forests such as other Governments possess, it would have to purchase estates free of rights, or to plant existing waste lands.

A striking feature illustrated in the Paris Exhibition is the excellent work done by forest societies. There are on the Continent societies which not only, as in Britain, work for the dissemination of correct forest principles and the discussion of improved methods, but actually possess and manage forests of their own. The Muscovite Society in Russia, for instance, owns twenty properties, with a total area of 870 square miles, carefully worked under simple working plans. Some such society in this country, beginning by small degrees, might gradually form a forest estate managed so as to pay financially, while being worked under the best and most scientific system. In America steps are being taken towards the establishment of forest companies, to acquire and manage estates for future yield; and something similar might be done in this country. A forest company acquiring properties would, under good management, yield a small dividend for a few years at first, but would form a good investment for the future.

APPENDIX No. III. (Q. 3).

Appendix III.

Handed in by Mr. Samuel Margerrison.

Relative Merits of British and Foreign Timber.

I consider an enquiry such as the present to have long been an important want, and hope it will have results of practical importance to sylviculture in this kingdom, because great reforms are needed, and most of those "practically" interested in the subject are lacking in information as to the best methods.

Continental foresters grow much larger crops of timber on similar areas than do British. This I have seen in the forests of North Germany, and have realised from the statistics of other countries. (The virgin forests of the remoter regions also seem to have better crops.) At the same time the trees are longer, straighter, and freer from knots and other defects than ours generally are, and the resultant timber is more useful for many (but not for all) purposes, and involves less waste in conversion into its ultimate products. More attention is paid to systematic and scientific forestry than in this country, where we have scarcely any special education on the subject for the young forester, or, indeed, for any of the large but scattered number of people engaged in the timber industry, in production and conversion. This is a serious handicap to the business, and the cause of our being behind several countries in efficiency in timber growing and utilisation of forest products. I might say a great deal more on this part of the subject, but others will no doubt be giving evidence on it, and I will not at present offer more than that, from my observation as a man daily engaged among British timber, I am in accord with the main principles advocated by several writers on this subject (three of whom, at least, I am glad to see are on this Committee); and also that I am of opinion that a very large proportion of the great volume of timber now imported from other countries could, with proper education and management, be profitably grown at home.

It is scarcely possible for one man to be able to compare all kinds of timber, British and foreign. Indeed, it is common knowledge that probably no one knows the ramifications of every branch of the British timber trade alone, because different districts of the country have different industries, and the home timber trade is, broadly speaking, made up of local specialities, owing to the great comparative cost of transport. For instance, merchants engaged only in supplying the London trade have no real conception of the immense colliery timber trade of some other districts. We in the north have no large chair-wood business like that of the High Wycombe district, whilst the south country merchants cannot have any chance of supplying the large quantity of timber used for making bobbins and shuttles in the West Riding, owing to its low price in comparison to cost of delivery. These are only just a few examples to illustrate this point; so that it would have been better, in some ways, if you could have seen your way to accept more than one witness from the Timber Federation to give evidence on the subject of the comparative merits of British and foreign timber. I had hoped to be able to lay before you some statistics of actual experiments which I know have been made for commercial purposes; but, as is perhaps only natural (it requires a considerable amount of public spirit for a firm to give away the results of costly experiments, to the enlightenment of possible rivals in business), I have not been so successful in obtaining these results as I should like, and I must fall back on generalities. These generalities, however, are based on practical knowledge of the special purposes to which they refer.

Any comparison of qualities must depend on the purposes for which the timber is to be used, and on the environment or system under which it has been grown. For instance, I know of no reason why we cannot grow as large crops of as clean, long, straight timber as, say, Germany. In fact, we have occasional patches of woodland under similar cultural conditions, producing similar results. But for some purposes the wood grown in this manner is not suitable. It is all right for use where clean grain, long lengths, ease of working, low price, and lightness of weight are required, and where the greatest durability is not necessary. And, I may add, that I do not consider it as necessary, in these days of rapid changes, to make all our appliances and constructions of so permanent a nature as it used to be. Sometimes an implement or erection which has been improved upon, or might be superseded, is retained simply because it is sound and good, long after it has ceased to be profitable to use it. And so, easily worked, cheap, long, clean grained, though less durable timber, may often be the best for its purpose.

But, on the other hand, where short length, durability, weight, density, and toughness are required, the trees grown under conditions recently practised in this country will yield more suitable timber. That is, the trees grown in our more open woods and in our hedgerows are, although shorter in the bole and rougher in the top, more durable, of greater density, and greater strength than timber grown closely together, as it is in the well-managed Continental and in the primæval virgin forests.

To take a few concrete examples:—

It almost seems superfluous to compare British oak with foreign. Very few countries grow oak timber equal to our own in size, strength, wearing, and lasting qualities combined. Some imported oaks are equal to ours in size, and (speaking broadly) they are superior in ease of working and freedom from coarseness and some other defects. But this freedom from defects is largely due to selection, I believe, and, judging from what we see in our old buildings, and in occasional woods of comparatively unthinned trees, our country can grow oak equal to foreign in these respects, and superior in the special good qualities of the species. The comparative coarseness of some of our oak is due to the system under which it has for some time been grown. British oak will withstand much greater torsional or twisting strains than almost any other. Hence its preferential selection for purposes where this strain occurs. For the framework of railway waggons it is eminently suitable. One of my customers simultaneously built as an experiment six railway waggons with the framework of English and six with a framework of foreign oak, for exactly the same purposes, and they were used in that way. By the time the waggons built on English timber foundations came in for repair, he tells me, the others were quite worn out. As nearly the same labour had been expended in building the latter as the former, it was true economy to use the somewhat higher priced British than *vice versâ*.

For general wheelwright work, where the implements are often exposed to sudden strains (as in the spokes) and to long exposure to the weather, it is found that by far the most serviceable timber for construction is British and not foreign oak.

For pit props, where heavy and non-cohesive roofs occur, it is found that oak props, although priced 60 per cent. more in first cost, are cheaper than the best foreign pine and fir props, because, besides bearing a heavier crushing strain in the first place, they can be withdrawn when no longer required, and by slightly shortening them they can be used again and again in other positions. Similar commendation can be made of our native larch.*

And for building and decorative purposes in domestic and public architecture, we have in British oak æsthetic qualities possessed by no other oak, and perhaps by no other timber.

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* A member of the Timber Trades Federation reports the case of a piece of land in Shropshire planted with larch in 1860, which produced a crop "realising a profit of £40 per acre." The same correspondent (Mr. Bowden, of Caswell and Bowden, Limited, Birmingham) says that where timber growing appears to be unremunerative, probably agriculture would be no less so.

Appendix III.

Other British-grown timbers, by the way, are not appreciated for their decorative effects. Home-grown acacia, yew tree, walnut, holly, and other species are capable of being used in many beautiful ways in the decoration of our homes—parquet, furniture, panelling, mouldings, &c.

For paving blocks it is found that built-up blocks of English oak, such as are produced in large quantities by one British company and its connections, are superior to most, if not all, other kinds; and this is a method of using up small pieces of what would be otherwise waste timber, which might be greatly extended. Then again, ladder staves and fence palings of British oak are superior to those of any other oak, so far as my experience goes.

To take another species:—German beech is grown in much heavier crops per acre than is our own, and no doubt it is very useful for some purposes. At the same time there are uses to which beech is put in this country, in large quantities, for which the German beech is utterly unsuitable, because of its lack of density and weight. For mallets, shuttles, spools, wheel-cogs, rollers, and similar products, it is much inferior to our own hard-grown and comparatively rough beech. Weight and resistance to repeated blows (resistance to indentation) are of more importance and value for these purposes than is the growing of large crops. A customer, a very large user, to whom I referred the question for confirmation, puts it in these words: "Such German beech as we have had was much inferior to our English beech, being light in weight, too free and open, and had not that solidity about it that ours had." I may add that we *can* grow beech of the same quality, and I think to the same extent of crop as can be grown in Germany, but it may not be the best thing to do in this country. Another disadvantage of imported beech is, that it is brought in in short lengths for stowage. Now felled beech is very rapidly attacked by rot at the transverse section ("end of grain") when cross-cut, and as our own beech can be forwarded in trees practically full length, it can be safely stored out of doors for a longer period if need be, without being attacked in this way to the same extent.

There is probably no ash quite equal to British ash, and no cheap foreign substitute takes its place. One of our members writes: "Ash timber of good quality is yearly becoming more scarce. The imports of this wood from foreign ports are increasing. Ash is a moderately quick growing timber, and would pay owners better than slow-growing wood, such as oak."—Mr. J. S. Remer (Messrs. Remer and Co., Liverpool— large users of ash).

The same gentleman also suggests that "All straight young suckers in hedgerows should be protected, so that trees 20 to 30 yards apart should be constantly taking the place of those cut down."

Where really rough wear is experienced, even British spruce is sometimes preferred to foreign, but as a rule the firs and pines generally are of a better quality in imported timber than in our own. This, nevertheless, is more a result of the system of sylviculture than of any inherent fault of our climate and soils. Take scaffold-poles, flag-poles, boat-stowers, and similar long, nearly parallel poles, for instance. The foreign spruce trees, having been grown in close proximity, have made longer annual growths, with, consequently, longer spaces between the knots, than ours do. Besides, these knots are smaller because their crowding in the plantation has destroyed the branches before they got to any size, the leaves being borne on the topmost branches only. There is also less liability to "cross-grained" timber from the same causes. The annual accretions to the tree are not laid on from youth to age in even layers from the root to the top of a 60ft. central pith, but are added, so to speak, "cone-on-cone." The longer we can get the annual cone, the less cross-grained will be the pole or tree, and at the same time the fewer the knots. So that even if we could grow the same bulk per acre, we should not get the same quality of long, clean-grained timber from our usual thinly-cropped woods.

On the whole, it would be much more profitable to grow our timber in thickly-planted woods, and in thinning, to preserve the leaf-canopy as intact as possible. This would often involve self-denial from realising, for present purposes, a capital which would pay much better if left to increase over a long period.

It costs, I take it, about 5d. to grow a cubic foot of fir timber in this country. On the average it costs at least another 5d. or 6d. to get it into the market, and it is sold (I speak from local experience) at 8d. or 9d. per cubic foot, that is, less than cost price. This selling price is ruled by the selling price of foreign fir. There is no reason why we cannot produce as cheap and good fir as other countries, but we cannot afford to sell it as cheaply (although we do so) because the cost of handling it and transporting it short distances is greater than the cost of the long distance traffic from abroad. Until some means of cheapening these handling charges is devised and adopted, the growing of cheap timber and transporting it in the round in this country will not pay, unless the "timber famine" which seems to be before us—owing to foreign supplies getting more and more remote—sends up prices. The relation of transport to value in the case of timber is of much greater proportionate importance than it is in the case of, say, corn. Where a ton of corn would cost 5 per cent. of its selling value in transport, a ton of fir timber would cost 60 per cent. A ton of spruce from the Baltic or even from Canada would not cost any more than, if as much as, a ton of spruce from the Yorkshire hills to the Yorkshire coal mines! Differential railway rates are costing timber growers as much as the rental value of much of the lands the timber is growing upon.

The fault of this is not all to be laid to the doors of the railway companies. Foreign timber imports are handled in larger quantities than ours, thus saving much cost in detail work. It is in handier forms than ours often is. Our timber is often in clumsy trees, crooked and knotty, forming comparatively light and dangerous loads per truck. But there is no indication that if any effort be made by our home producers and merchants to centralise their work, make their loads more compact, and arrange for regular and large consignments, that the railway companies would make their charges equal to those on imported timber. Straight and crooked, large lots and small, compact loads and light ones, are all charged at the same rate. There is a growing tendency to use road locomotives for moving timber in some districts, and it is said to have resulted in considerable saving where the roads are suitable. But good roads do not, as a rule, penetrate into the woods, and there are sometimes weak bridges and sharp corners to negotiate with long, heavy loads. So that this competition can only be partial. And in this country we have not the advantage of rivers and water-shoots, nor the certainty of frosts to harden swampy places, as is the lot of some timber countries.

The question of transport is perhaps the most important one for growers of timber to consider in connection with their forestry, because it is of little use to grow large and valuable crops unless there is an available market for them. At the same time, the life of a tree is a long one, and that of a forest longer, and if conditions of transport change as much for the better in the next eighty years as they have in the past eighty, there will be no fear of being able to place the crop in an advantageous market.

Special attention should be paid, in forming or renewing forests, to concentration of production, the production of timbers of the higher values where possible, compactness of loads, and regularity of supplies. By these means the relative cost of transport will be reduced.

The regulations and conditions of sale of British timber are much modified by the stringency with which they are drawn up for the protection of game. Merchants cannot give as good prices for timber when the time of removal is limited to short and inconvenient periods, as they could if they had a more extended time. And the timber has sometimes to be felled "out of season" for the same reason, and so its quality is impaired. With care and good management, the owner of extensive woodlands need have no lack of good shooting, whilst at the same time studying the convenience of his customers. But, as a rule, he is guided more by his gamekeeper than by his forester, greatly to his and his family's loss.

Hundreds of thousands of acres of what is now unproductive land could profitably be planted with timber. A few weeks ago I was valuing a large plantation of fine ash and oak, with splendidly-growing younger sections, the whole worth an average of £80 per acre, adjoining exactly similar land let as a farm (including a very good homestead, and landlord paying rates) at 7s. 6d. per acre. There are hundreds of thousands of acres of similar land, which would pay much better if planted with trees. The sporting value would be as great, and in many cases greater than it is at present. The chief reasons why more is not done in planting such

Appendix III.

properties are, I take it, (1) not calculating the loss there is being sustained, and (2) lack of capital to carry out the work.

My opinion, and that of some other members of my federation, is in accordance with those who have advocated Government assistance by grants of money (with efficient supervision) to individuals and corporations, for the purpose of planting land which is at present comparatively unproductive. The supervision which such grants would involve, if carefully planned, would secure that systematic culture and tending of crops of timber which at present are generally absent. "Working plans" to cover a long period of time are needed in order to supersede the present disconnected and wasteful practices of timber production, whether the result of temporary necessities or lack of knowledge. This country (like others) has for a long time, in matters sylvicultural, been living on its capital instead of its income. We have consumed more than we have produced, instead of providing a larger stock to meet the demands of the ever-nearing day when foreign supplies are too remote to be imported at a price less than we could ourselves have grown them. A member of our federation (Mr. Remer) suggests that it "be compulsory for all owners of land to re-plant where the land is not converted into arable land."

We also require a larger and more thorough and penetrating system of education on forestal matters, not only for the young forester and owner, but also for all who are engaged in the timber industries. (I would even go so far as to suggest that a chapter or two on a few first principles of tree-growing be introduced into children's school reading-books.) And the system of technical forestry education ought to be such that, at a number of well-distributed centres throughout the kingdom, it would be possible for students to obtain sufficient scientific and practical training, and where possible, see and do actual forestry work, within easy distance of all the country districts. Many a wood is destroyed by some forest enemy, many a wood is allowed to stand after it has ceased to be profitable, and many a piece of land is allowed to lie unproductive, and many a wood is wrongly formed and tended, which would not be allowed to do so, if the true principles of sylviculture were more generally taught.

APPENDIX, No. IV. (Q. 159).

Appendix IV.

HANDED IN BY MR. SAMUEL MARGERISON.

EXTRACT, RELATING TO TIMBER, FROM THE GENERAL RAILWAY CLASSIFICATION OF GOODS, 1902.

TIMBER.

1. The term "Timber" embraces all descriptions of Wood in an unmanufactured, or roughly hewn, or roughly sawn state; but (except when otherwise specifically stated) not any Wood shaped, or prepared, or partially prepared, or any description of Wood separately specified in the Classification.

2. For Square Timber the divisor of 144 is used.

3. In the measurement of Round Timber, when carried at measurement weight, the divisor of 113 is applied, measurement being taken by string under bark (or by string over bark with a reasonable allowance for the bark), except when such Timber is consigned at tape over bark rates, or it is agreed that tape over bark rates shall apply.

4. The right is reserved to require payment for the carriage of Bark upon Round Timber charged on the 113 divisor in addition to the rates charged for such Timber.

5. When Round Timber is carried at tape over bark rates the divisor of 144 is applied, measurement being taken by tape over bark.

6. Round Timber—
   (i.) Between Stations on Scotch Railways.
   (ii.) From Stations on Scotch Railways to Stations in England and Wales.
   (iii.) From North Eastern Railway Company's Stations.
   charged at measurement weight, is carried at tape over bark measurement with the divisor of 144, the rates being exclusive of loading, for which service, when performed by the Company, an additional charge is made.

7. When Debenture, Octagonal, Waney-edged, or other Timber of defective angle is measured by calliper (as Square Timber), the 144 divisor is used, but an allowance is made of 22½ per cent. When Debenture, Waney-edged, and defective angle Timber is measured by tape or string, the 144 divisor is used, but in such case the allowance as when measured by calliper is not made. Logs practically square, not to be treated as Waney-edged Timber.

8*. Baltic Sleepers and Sleeper Blocks are charged at measurement weight on the following basis:—
   Sleepers 10 inch by 5 inch by 9 feet rectangular, 16 creosoted and 17 not creosoted, to be taken as equal to 1 ton.
   Other dimensions *pro rata*.

9*. Lathwood (not Laths) is charged per square fathom, or 36 square feet, 9 cwts. per foot in length.

10. When Timber (other than Round Timber, and except Sleepers, which are already provided for by clause 8) chargeable at measurement weight, is creosoted, an addition of 5 per cent. is made to the weight for the creosote.

11 When ascertaining the measurement weight of Creosoted Telegraph Poles, Telephone, Ricker, and Scaffold Poles, 5 per cent. is added thereto in respect of the creosote.

12. All Timber in pieces of or over six tons measurement to be charged 25 per cent. over usual rates.

13. The weights of the various descriptions of Timber must be computed from the measurements upon the following bases:—

Acacia.
Ash.
Baywood.
Beech.
Boxwood.
Ebony.
Greenheart.
Gumwood.
Hickory.
Holly.
Hornbeam.
Ironwood.
Jarrah Wood.
Karri.
Lignum Vitæ.
Mahogany.
Oak.
Padouk.
Sabicu.
Satin Walnut.
Teak.
or other Heavy Timber.

40 cubic feet are taken as equal to 1 ton.

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* Not applicable to traffic between stations on Scotch railways.

Appendix IV.

Alder.
Birch.
Cedar.
Cherry.
Chestnut Wood.
(Spanish and Horse).
†Elm.
Fir.
Hemlock.
Kauri Pine.
Lancewood.
Larch.
Maple.
Pine.
Pitch Pine.
Plane.
Poplar.
Rosewood.
Satinwood.
Spruce.
Sycamore.
Walnut.
or other Light Timber.

50 cubic feet are taken as equal to 1 ton.

† When elm is measured by string under bark (or by string over bark with the allowance for bark) with the 113 divisor, 40 cubic feet are taken as equal to one ton.

14. Except as provided in clause 6, the rates for Round Timber, unless otherwise noted, include the ordinary service of loading from beneath the crane when the Company perform that service, but are exclusive of haulage to the crane when the Timber has been previously deposited at a distance therefrom. When the Company do not perform the service of loading, a rebate is allowed.

15. The rates for Round Timber do not include unloading.

16. Round Timber at measurement weight is charged at exceptional rates.

17. When Timber is consigned by measurement weight, the number of cubic feet must be declared by Senders when consigning the Timber. If at request of Senders the Company ascertain the measurement, a separate charge is made for such service.

18. For pieces of Timber weighing less than 4 tons each in weight, which on account of their length require more trucks than one for their conveyance, a minimum charge is made of 1 ton per Truck for each Truck used whether carrying part of the load or used as a Safety Waggon only.

19. Pitwood, for mining purposes, at measurement weight, is charged at tape over bark measurement, 144 divisor.

Not applicable to traffic between Stations on Scotch Railways.

(1)		(2)		(3)		(4)		(5)		(6)	
The following are charged at Exceptional rates noted for Deals, Battens, and Boards, or, in the absence of Exceptional rates, at Class C. rates, in consignments of 2 tons and upwards.		The following are charged 10 per cent. OVER the Exceptional rates noted for Deals, Battens, and Boards, but not to exceed the Class C. rates, in consignments of 2 tons and upwards.		The following are charged 20 per cent. OVER the Exceptional rates noted for Deals, Battens, and Boards, or, in the absence of Exceptional rates, at 20 per cent. over the Class C. rates, in consignments of 2 tons and upwards.		The following are charged 10 per cent. LESS than the Exceptional rates noted for Deals, Battens, and Boards, or, in the absence of Exceptional rates, at 10 per cent. less than the Class C. rates, in consignments of 2 tons and upwards.		The following are charged at Class C. rates.		The following are charged at Class 1 rates in less lots than 2 tons.	
Deals, Battens, and Boards unprepared (not exceeding 4 inches in thickness) of Fir and Pine other than Pensacola or other Pitch Pine Deals, Battens, and Boards	At 66 cubic feet to the ton.	Flooring Blocks (*not parquetry nor inlaid*) -	Machine Weight.	Pitwood, exceeding 9 feet in length consigned direct to a Mine. Telegraph, Telephone, Ricker, and Scaffold Poles (including *Creosoted*) — *see* clause 11.	Measurement Weight.	Pitwood consigned direct to a Mine - -	Machine Weight.	Baywood - - Cedar, *in logs or sawn into planks* Cherry-Tree Wood Hickory, *unsawn* Jarrah Wood - Lancewood, *unsawn* - - - Mahogany - - Maple, *sawn into planks* - - Padouk - - Sabicu - - Walnut, *in logs or sawn into planks*	Measurement Weight.	Flooring Blocks (*not parquetry nor inlaid*) - Pieces of roughly-sawn wood, in short lengths, tied in bundles, (for making packing boxes). Telegraph Pole Cross Pieces -	Machine Weight.
Pensacola or other Pitch Pine Deals, Battens, and Boards unprepared, not exceeding 4 inches in thickness - - -	At 55 cubic feet to the ton.										
Any of the following sawn into planks, or sawn or hewn into square or waney-edged logs :—											
Alder. Ash. Beech. Birch. Chesnut. Elm Fir. Hemlock. Hornbeam. Larch. Oak. Pine. Pitch Pine. Plane. Poplar. Spruce. Sycamore. Teak.	Measurement Weight, as per preceding page.	Boards, Flooring, prepared, and other planed or prepared Boards (*not parquetry nor inlaid*) - -	Measurement Weight.					Cocus Wood - Zapateria Wood - Telegraph Pole Cross Pieces -	Machine Weight.	Boards, Flooring, prepared, and other planed or prepared Boards (*not parquetry or inlaid*) - -	Measurement Weight.
Sleepers, Wood (including Creosoted)—*see* clause 8 - - Stavewood (not Staves) - - Lathwood (not Laths) - -	Measurement Weight.										
Posts and Rails, *Fir*, cut square for Fencing (not exceeding 4 inches in thickness) - -	At 66 cubic feet to the ton.	Boards, tongued and grooved—(as planed or prepared boards).									
Posts and Rails, cut square for Fencing, including Morticed Posts and Scarped Rails, but excluding Posts with butt ends, no allowance in measurements to be made for morticing or scarping, or other inequality - - - -	Measurement Weight.										
Posts cut square, with butt ends for fencing - - - - Paving Blocks, Wood - - Pieces of roughly-sawn wood, in short lengths, tied in bundles (for making packing boxes) - - - -	Machine Weight.										

APPENDIX, No. V. (Q. 793.)

Appendix V.

Handed in by Mr. Andrew Slater.

Example showing the outcome of 40 acres of a mixed Larch and Fir Wood at the end of the seventy-fifth year.

This wood, situated in the south of Scotland, had a north-western exposure, and rose from an elevation of about 650 to one of about 1,000 feet. The soil is of a light loam, full of stones and boulders, and rests on a whinstone formation (Greywacke), and would scarcely be worth 1s. per acre. Previous to 1884, probably, from £1,500 to £2,000 worth of wood had been extracted, but in the early part of that year 1,218 trees were blown over by the severe gale that passed across the country then. In 1886 these trees were prepared, put into lots, and sold, and realised, after deducting expenses, the sum of £277 7s. 6d., or about half what they would have brought previous to or five years or so after the storm took place. In 1892 2,208 larch and 811 spruce were cleared off, and realised a net sum of £1,433 1s. 2d. In 1893 the final portion was cleared of 4,603 larch and 1,224 spruce, etc., and realised a net sum of £1,636 12s. 6d. After deducting a sum of £10 10s. for sundry disbursements, the total net sum realised for the 40 acres was £3,336 11s. 2d.

Assuming that previous to 1884, after deducting 17 per cent. for expenses, £1,245 worth of wood had been extracted at various periods, and taking the yearly rent and other expenses as being at the rate of 2s. per acre, and the cost of formation at £3 10s., the following calculations at 3 per cent. give the financial outcome.

Financial outcome of the foregoing at 3 per cent. Compound Interest.

Age when Extracted.	Sum realised.	Years to end of rotation.	Value at end of rotation.
	£.		£. s. d.
30 years	130	45 years	491 11 10
45 "	250	30 "	606 16 –
55 "	400	20 "	722 8 3
65 "	465	10 "	624 18 3
68 "	277	7 "	340 13 1
74 "	1,433	1 "	1,475 19 9
75 "	—	—	1,636 12 6
			5,898 19 8
2s. annual rent over 75 years £1,090 10 – Cost of formation, at 3l. 10s. per acre 1,285 – –			2,375 10 –
		Total £.	3,523 9 8

Which is equal to 92l. 5s. per acre, or to an additional annual rent of 6s. 2d.

APPENDIX, No. VI.

Appendix VI.

Handed in by Mr. W. B. Havelock, Brocklesby.

Particulars of Receipts and Expenditure of the final clearance of an 18-acre plantation, 75 to 80 year's growth in the North Riding of Yorkshire, felled off in 1890–91.

The timber was offered, standing, in 4 lots, by tender, and the highest offers were accepted. The timber afterwards was felled and measured by the vendor, and realised as follows:—

Timber, &c. Sold.

				£. s. d.		Per foot. s. d.
1,327 Larch	50,626 feet	=	38⅛ feet per tree,	2,666 18 8	=	1 –½ +
261 Scotch	3,480 "	=	13⅓ " "	53 11 11	=	– 3½ +
74 Oak	891 "	=	12 " "	33 19 9	=	– 9 +
116 Beech	3,448 "	=	29¾ " "	84 10 6	=	– 5¾ +
35 Birch	431 "	=	12⅓ " "	8 8 2	=	– 4½ +
12 Sycamore	327 "	=	27¼ " "	14 19 9	=	– 11 +
120 Ash	1,690 "	=	14 " "	84 10 –	=	1 – +
4 tons Oak bark, at 87s. 6d. per ton		=		17 10 –		
Fuel sold				17 15 6		
1,945 Trees—60,893 feet				2,982 4 3		
Less discount				73 13 5		
				2,908 10 10		
Add 1 Larch—144 feet (and 1 Scots fir, 40 feet)				8 10 –		
				2,917 – 10		
Add also timber used on the Estate:— 359 feet Larch and Oak, at 1s.				17 19 –		
				2,934 19 10		

Deduct Expenditure as follows:—

	£. s. d.	
Actual cost of felling, harvesting oak-bark, dressing and measuring the timber	92 4 2	
Advertising, showing timber, and other petty expenses, say	7 11 10	
		99 16 –
Total Nett Receipts		£. 2,835 3 10 = £157 10s. per acre

Appendix VI.

The land was not worth more than 7s. 6d. an acre for agricultural purposes, and directly it was cleared it began to go back to heather and gorse.

Unfortunately there is no record available of the return from the thinnings, but the old woodmen used to say that several hundreds of pounds worth had been sold at different times, besides what was used on the estate.

It may be added that in measuring the larch and Scots fir, an allowance was made for bark of ¼ inch in the quarter girth on all trees girthing 8½ and under, and ½ inch on trees 8¾ inches and above. The oak was measured under bark, and the other hard woods over bark.

Assuming that plantations up to 40 years of age will yield thinnings of sufficient value to pay labour incurred in repairing fences, thinning, etc., but will do little, if anything, towards reducing the outlay originally expended; and that after 40 years of age, in addition to paying for labour, the thinnings ought at least to be of sufficient value to prevent further interest accumulating on the principal, and to pay the rent, we may estimate the annual return per acre on this plantation as follows:—

Taking the cost of planting and fencing to be £8 per acre, then £8 at 4 per cent. compound interest for 40 years equals £38 8s. To this add the rent at 7s. 6d. per acre per annum, acumulating at 4 per cent. per annum compound interest, which amounts to £35 12s.; these together make £74, which is the debt per acre on the plantation at the final fall, thus leaving a profit of £88 10s. per acre for the whole period of 80 years, or £1 0s. 10d. per acre per annum. This may be taken as an example of a successfully managed plantation.

This ground, with an acre of old gorse added (making 19 acres altogether) was replanted with trees 4ft. apart in January and February 1898; and owing to the prevalence of larch disease it was considered advisable to plant chiefly hardwood.

Particulars of Cost.

	£.	s.	d.
Value of 1,000 yds. of new 4-rail fencing, 3 ft. 6 in. high - - - - - - -	27	10	-
Erecting the same - - - - - -	3	15	-
Clearing ground for planting - - -	1	-	
Digging 50,000 pits at 1s. 4*d*. per 100 - -	33	6	8
Planting 50,000 trees - - - - - -	25	7	9
Value of 50,000 trees, consisting of 15,000 ash, 1½ ft. to 2 ft.; 20,000 sycamore, 1½ ft. to 2 ft; 2,000 hornbeam, 2 ft. to 3 ft.; 5,000 Scots firs, 1 ft. to 2 ft.; 2,000 spruce, 1 ft. to 2 ft.; 2,000 native larch, 1 ft. to 2 ft.; 4,000 Japanese larch, 1 ft. to 1½ ft. - -	67	5	-
	158	4	5
The dead trees were replaced in January and February, 1899, at a total cost for trees and labour of - - - - - -	16	10	-
£.	174	14	5

Which is at the rate of 9*l*. 3*s*. 11*d*. per acre.

	£.	s.	d.
In equity, only half the cost of fencing should be charged to the plantation; the remainder should be borne by the adjoining land. Therefore, taking the total cost of planting as above - - - -	174	14	5
Deducting half cost of the fencing -	15	12	6
£.	159	1	11

Which is at the rate of 8*l*. 7*s*. 6*d*. per acre.

To prevent damage by ground game it was necessary to enclose the area on three sides with wire netting, but strictly speaking this outlay should be charged to the game account, and not to the plantation.

The cost was as follows:—

	£.	s.	d.
1,000 yds. of 4-ft. combined mesh galvanised wire netting, No. 18 gauge (33 inches of 1½ in. mesh and 15 ins. of 2½ in.), at 26s. 6*d*. per 100 yds. - - - - - - -	13	5	-
1,000 yds. of No. 9 galvanised solid wire	-	18	-
9 straining and 70 driving posts - - -	2	8	6
Erecting the above - - - - - -	4	-	-
£.	20	11	6

equal to 1*l*. 1*s*. 8*d*. per acre.

Summary of Cost per acre of replanting.

	£.	s.	d.
Total outlay on preparing ground, fencing, plants, and planting, including one filling up - - - - - - - - -	9	3	11
Add total cost of netting - - -	1	1	8
£.	10	5	7

Appendix VII.

APPENDIX No. VII.

HANDED IN by MR. W. B. HAVELOCK.

Rabbits. The damage done by rabbits to the plantations of this country is enormous, and cannot be over stated. No one but the forester has any idea of it. They effectually prevent that natural regeneration of the woods, which is so striking a feature in some of the North German and French forests. Even where to the casual observer there seems to be a fair crop of young trees left, if the wood is carefully examined it will be found that the ash, elm, and beech, and even young oak are more or less barked near the ground, and many of them entirely peeled round. Birch and other less valuable sorts will not be touched, but the trees that in the future should form the permanent crop are hopelessly ruined. The poor forester attempts to fill in suitable trees again and again, with the hope that they may escape the rabbits, but he loses heart in the long run, and realises his helplessness as opposed to the mighty power of the rabbit.

Wire netting is in many—and I am sorry to say in most—cases a delusion. Be it ever so efficiently erected and looked after, rabbits get in, by fair means or foul, and once in they are difficult to exterminate. Of course when the forester has power to kill the rabbits inside the netted enclosures, he has a chance to grow the trees up to the time when it is thought advisable to take down the netting. After that the wood must take its chance.

Pheasants. The preservation of pheasants when carried to an extreme also prevents, to some extent, the natural regeneration of the woods of this country. The birds eat up all the acorns and beech mast, and I have noticed recently that they will pull up in a wholesale way the budding ash seeds in the nursery, but the damage they do is infinitesimal as compared with that done by rabbits.

Hares. Hares also do damage by cutting off newly-planted trees, but they are not so numerous as rabbits, and trees need only be protected for two or three years against them.

Thinning. It is my firm opinion that in this country more damage is done to woods by over-thinning than from want of thinning. In saying this I do not wish it to be understood that I think this always arises from want of knowledge on the part of the forester. In many cases he is simply told that so much money is required, or that such and such a wood must be thinned in order to furnish better cover for game. But no doubt many foresters do not know the why and wherefore of thinning, and have probably never had a chance to see other woods than those they are in charge of. Again, many owners object to clear off even ripe woods, either from sentimental reasons, or because they do not wish to alter the appearance of the landscape, or they feel themselves unable to bear the cost of replanting. If

Appendix VII.

money is urgently needed the order is given to the forester to thin heavily. The so-called "German" system of forestry is, in my humble opinion, only a going back to the "natural" way. I know that on one of the best wooded estates in England, the trees were originally planted about 3 feet apart, and as I have heard very old woodmen say, they were so close that they had to creep in to thin. The early thinnings were chiefly used for fuel at the time, and little more than dead or dying trees were taken out. And what is the result to-day? These woods contain as well-grown, lengthy, and clean timber as can be found in this country or Germany either. I have seen spruce at Killarney, and in some places in England, equal to any that I saw in 1895 in the Hartz Mountains.

Present supply of Foresters.

I am not quite certain but that at the present time there are as many competent foresters in this country as there are appointments to be filled. After all, parents consider before having a son trained up as a forester whether the emoluments attached to the employment are such as to warrant them doing so, and it must be admitted that except on some of the largest estates, the pay is not such as will attract the best men. A forester on a large estate has to know "something about everything": from the seedling in the nursery to creosoting the full-grown tree.

Creosoting.

This suggests to me that the importance of creosoting the cheapest sorts of timber, and using it locally, is not sufficiently recognised in this country. No doubt the first cost of the plant deters many proprietors, but if they took into consideration that it costs as much per foot to remove spruce or pine worth (say) 2d. to 3d. per foot in the wood, as it does oak or ash worth 2s. or 2s. 6d. per foot, or larch 1s. 3d. per foot, surely they would see how necessary it is to keep the lowest priced wood at home. It is understood of course, and allowed by anyone with a practical knowledge of the subject, that creosoted pine or spruce will last as long as uncreosoted larch. The advantages of creosoted timber are now so universally recognised that it is not necessary for me to labour the point, but I may say that creosoted spruce posts put down eight years ago are to-day apparently as good as they were when first put down. Of course in cutting up these cheaper kinds of timber for fencing, it must not be forgotten that it is often necessary to have the posts and rails a little thicker than if cut out of better timber.

To carry out a large scheme of afforestation would create more work in many sparsely populated districts, and of such a kind that is attractive to many men. "Once a woodman always a woodman." There is something in the free and natural life of the woods that appeals to nearly every man. Certainly I have not known in my time many woodmen desert the woods for the life of the city. The need of country-bred men for the army has been demonstrated *ad nauseam* during the South African war, and one of the results of extending the area of the forests in these islands would be to increase the number of such men.

APPENDIX No. VIII. (Q. 1161.)

Appendix VIII.

Handed in by Mr. A. C. Forbes.

Suggestions for the Improvement of British Forestry.

I. *Appointment of a Standing Committee on Forestry by the Board of Agriculture, with a Staff of Consulting Experts.*

This might be a small committee chosen from the staff of the Board of Agriculture, with the addition of such expert members as may be desirable.

The duties of this committee might be:—

(a) The answering of all inquiries respecting practical forestry and applications for advice on the same.

(b) The consideration of all applications for financial assistance made to the Board under Suggestion II., and the inspection of the woods or timber with respect to which it has been made, together with the nature of the proposed work.

(c) The inspection of land on which planting by the Government is contemplated or suggested, and the supervision of the work if undertaken. (See Suggestion III.)

(d) The appointment of sub-inspectors in each district or locality in which an improved system of wood management is desirable. These sub-inspectors might be appointed by the Standing Committee to give advice on all practical matters connected with wood management when required, by visiting the woods in their respective districts under the direction of the committee, to whom applications for such advice would be made by the proprietors. They might be selected from qualified practical foresters resident in the various districts, subject to the consent of their employers, with whom an arrangement might be made as to scale of payment and other matters.

(e) The editing of a special forestry supplement to the Journal of the Board of Agriculture.—This supplement might become a recognised official medium for the publication of all matters connected with British forestry, receive and publish approved articles and extracts, and publish translations of suitable matter from Continental and other forestry journals.

(f) The collection of data and statistics relating to British forestry and the home timber trade, and the organisation of experiments and investigations in practical forestry.—This work might have special reference to the stock and annual consumption of home timber by obtaining annual returns of all timber sold and used on estates throughout the British Isles, together with prices and other details. Experiments and investigations in practical sylviculture might be organised in conjunction with estate foresters and the results published from time to time in the supplement already referred to.

II. *Advance of Loans to Landowners by the Government*, security to be given in the form of middle-aged or nearly mature woodlands, and the loan to be expended on planting or other approved forestry work.

The principle on which these loans would be granted would be that of enabling the landowner to mortgage his growing timber at a low rate of deferred interest to the Government for the express purpose of improving and extending the woodland area of the estate. By this means he would not be called upon to sacrifice his personal interests as a life-holder for the benefit of his heirs, while the necessity or temptation to cut a crop of growing timber prematurely would be removed. In the growing crop the Government would have ample security for the amount of the loan, which would be repaid with interest when the timber became ripe, while the life-holder at the time of its repayment could recover his personal loss by effecting a fresh loan on another portion of woodland. By such a system the Government would become the mortgagee of a certain quantity of growing timber, and would, at the same time, benefit not only the woodland proprietor, but remove one of the greatest obstacles to the improvement of woods and the planting of waste land without any sacrifice of public money, although it would involve a temporary loss of interest until the period for which the first batch of loans were granted had expired.

This system of loans might be arranged in the following manner:—

(a) The provision of the amount required.—The necessary amount might be obtained by the formation of a special fund, named "The Forestry Improvement Fund," formed and maintained by a special annual grant from the Treasury to the Board of Agriculture for apportionment as required.

(b) Conditions under which a loan would be granted.—A woodland proprietor wishing to obtain a loan from this fund would have to comply with certain conditions. He would first have to specify the wood or woods he wished to offer as security for it. Such woods would have to be within a reasonable distance of maturity, [Appendix VIII.

possess all the qualifications indicative of a sound, healthy, and growing crop, and consist of a species or number of species for which a good commercial demand exists. It would have to be inspected by the Standing Committee, and its existing and prospective value carefully judged. The committee would also inspect the planting or other work for which the loan was required, and form an opinion as to its benefit to the estate and the promotion of good forestry. Both of these features being satisfactory, the Minister of Agriculture could then grant a loan not exceeding in amount the present value of the wood on which it has been raised, the necessary deductions being made for any contingencies which might depreciate its value during the remainder of the rotation.

(c) Repayment of the Loan.—The period over which the loan might extend should not be more than 30 years or less than 15 years, and its date of repayment should coincide as near as possible with the end of the rotation of the timber crop as provisionally fixed by the committee. Between the granting of the loan and its repayment, both the management of the mature wood and the young plantations or other work undertaken should be managed and carried on according to directions given by the committee, and the latter should also have power to inspect the woods and work from time to time during the period. The proprietor would be obliged to carry out the instructions given to the best of his ability, and to give satisfactory reasons for any deviation from them.

Upon the repayment of the loan Government supervision might cease, and the owner would have full control over the mature wood, and be at liberty to fell or retain it standing as he pleased.

On entailed estates the interest of the heir or heirs-at-law would be fully safeguarded by the Government conditions, but special arrangements might be made in the event of the loan being still outstanding at the death of the borrower.

III. *Formation of State-controlled Forests in Rural Districts containing too small a proportion of Woodland.* (Land for the purpose to be acquired by purchase or rent free by an arrangement with the owners.)

The advantages derived from the afforestation of poorly-wooded districts are chiefly dependent upon the manner in which the land is already utilised, and the capability of the soil to produce timber crops. In the neighbourhood of large manufacturing centres, where the land is of fair quality and its cultivation highly developed, extensive forests would be out of the question. In thinly populated districts, with large areas of poor and almost useless land for agricultural purposes, the expediency of afforestation depends upon the ability of the soil to produce timber. The agricultural value of land alone affords a very imperfect guide as to its value for producing timber, owing to the fact that the depth of soil is more important than its quality, and the character of the subsoil may be of equal or greater importance than that of the surface soil. In agricultural districts woods have an important influence upon the welfare of the labouring classes by providing them with employment during a season of the year when most farm work is at a standstill, and thus tend to check rural depopulation. Woods have also an indirect value, due to their ability to improve the agricultural value of adjoining land, by the shelter they afford to stock, and the prevention of undue evaporation from the surface. They increase the residential value of adjoining land by improving the landscape, and by affording facilities for sport, and by giving birth to minor industries amongst village communities.

Keeping the above point in view, it appears desirable that a fair proportion of woodland should exist in every parish or district. In the neighbourhood of country mansions standing on large estates, sufficient woodland usually exists to satisfy the requirements of rural economy. But on non-residential estates, and frequently on the fringes of residential properties of large extent, the proportion of woodland is frequently very small, and it is in such districts as these that the question of afforestation deserves serious attention.

The following means might be adopted in effecting the object desired :—

(a) Selection of District Suitable for Afforestation Purposes.—This might be undertaken by the Standing Committee on Forestry, whose attention should first be directed towards exceptionally thinly populated districts, as indicated by the Census Returns. Enquiries amongst landowners in such districts would elicit information as to the approximate quantity of land available for afforestation, and their personal opinions on the matter, and willingness to co-operate with the Board of Agriculture in the event of action being taken. Should the replies received to such enquiries be favourable to Government action, the districts might be visited by the Committee and an inspection made of the land available.

(b) Selection of Land in such Districts.—The great amount of attention drawn to the question of planting waste land has led many to suppose that the whole extent of waste land in this country could be planted with advantage. Such, however, is very far from being the case. The belief that trees will grow anywhere is perhaps justified as far as their existence goes, but profitable forestry requires that trees must grow at a fair rate, and the timber be of good quality when grown. To plant large areas of unsuitable land from which there is no likelihood of a return would not only be a waste of money, but would do more than anything else towards creating opposition towards a scheme which ought to be both economic and philanthropic at the same time. Very great care and judgment would be necessary in the selection of such land as would justify, by its profitable production of timber, the arguments which advocates of afforestation have long advanced.

The class of land best adapted for the purpose is probably that comprised of deep sands and gravels, which form a poor, comparatively worthless surface soil, but which are deep and porous enough to allow trees' roots to penetrate to a depth which ensures them ample feeding ground and moisture. For the purpose in view, it would not be absolutely necessary for the land acquired to be entirely waste or unutilised. There are extensive tracts of poor arable and pasture ground which would yield a better return under timber than they do at present, and the most favourable instances of profitable forestry are probably found on such land. This would have to be taken into consideration by the Committee, and not only the quality, but the available extent, position, and boundaries of the land in question judged in relation to each other.

(c) Acquisition of the Land when Selected.—When a tract of land which fulfils the required conditions has been selected, the best means of acquiring it have to be considered. It is taken for granted, of course, that the present owner or owners are in sympathy with the object contemplated, and would be willing to lend, lease, or sell to the Government for afforestation work.

The land might be acquired rent free for a certain period by a special arrangement with the owner, at the end of which period the owner would have the option of buying the timber crop at its cost value, or of selling the land to the Government at its original value, plus the accumulated value of the ground rent during the period. In either case this arrangement would benefit both parties to the agreement. The owner who purchased the plantation would have avoided the necessity for sinking the sum required for its formation at the outset, while the Government would have been spared the payment of rent for ground which brought in nothing to the Exchequer. As security for the outlay would be the unimproved value of the land, and as security for the deferred rent charge would be the growing timber crop. The temporary loss of interest would be shared by both, that on the outlay by the Government, and that on the land by the owner.

As an alternative to the direct purchase of the crop by the owner of the land, his renting of the timber crop until the end of the rotation might be possible, the rent being fixed sufficiently high to repay the Government for the original outlay and loss of interest. By this method the timber crop would revert to the landowner or his heirs at the end of the rotation.

The leasing or direct purchase of land calls for no remarks, being simply a question of finance. A method which might be found practicable in some cases, however, is that of leasing or purchasing existing woodlands, and increasing their value by improved management, thus avoiding the temporary loss of interest peculiar to most or practically all other methods of afforestation. These might form the nuclei of Government forests, which later on might be extended by the purchase of surrounding land.

Many proprietors who are unable to work their woods profitably themselves might be induced to lease or sell them, providing they were allowed to retain the shooting rights, which often constitute their chief value in the eyes of the owner.

The active co-operation of County Councils might be obtained in work of this kind, and would tend to give any scheme decided upon the necessary amount of

Appendix VIII.

decentralisation without which the necessary degree of economy would be difficult. As regards finance, for instance, the cost of management and maintenance might be borne by County Councils, the necessary amount being partly supplied out of the county rates on a basis of equitable adjustment, whereby the district especially benefited by the work would bear the increased burden it entailed. There is no reason why county forests should not be formed and maintained on the same footing as the municipal forests of other countries, and they would ultimately become a source of revenue in themselves, and at the same time increase the prosperity of the rural population, both directly and indirectly.

IV.—*Practical Demonstrations in the Woods, and Short Courses of Lectures on Sylviculture to Working Foresters and Woodmen in convenient centres.*

The educational needs of working foresters are not great as regards the science of forestry, but there is much room for improvement in their knowledge of practical sylviculture. Great losses are annually incurred by woodland proprietors through this lack of knowledge in the various details of planting, thinning, pruning, the protection of woods from ground game and injurious insects, etc. These might be avoided if the elementary principles of these operations were understood and observed by those immediately in charge of woods, but so long as the latter's knowledge is purely empirical and local, no improvement is likely to take place.

(a) Practical Demonstrations.—In the case of the older generation of men no great success would be likely to follow an attempt to reach them by means of lectures, but they might be brought to take a more intelligent interest in their work by being brought into contact with a qualified forester for a day now and again, in the course of which much valuable information might be imparted in the simple interchange of ideas, and in ordinary conversation.

Such interviews might be brought about by proprietors and agents without their object being directly stated to the men they are intended to benefit, for reasons which are obvious. A little advice given locally and according to the requirements of the case may do more good than a great deal given generally without especial application.

(b) Short Courses of Lectures.—Short courses of lectures by qualified men might be arranged in districts and centres accessible to a reasonable number of working foresters and woodmen who have an ambition to rise above the ordinary level. Such lectures should be arranged in conjunction with the woodland proprietors of the district in which they would be given, and who might give their employees the necessary facilities for attending.

The provision of a lending library of forestry works might also be of value, by giving the men attending the lectures an opportunity of extending their knowledge.

APPENDIX No. IX. (Q. 2079.)

Appendix IX.

HANDED IN BY MR. ARTHUR VERNON.

Mr. Arthur Vernon has been engaged for nearly forty years in the management of a large number of estates having beech and other woods and plantations thereon, and has been extensively concerned in planting, especially in the neighbourhood of the Chiltern Hills.

In the last-mentioned district beech woods are a valuable source of revenue, and the soil and climate especially favour their growth. Much land was denuded of timber in the middle of the last century, which is of little use for agriculture, and would be a large source of revenue if replanted.

Beech succeeds best when it is self-sown, and beech woods require special treatment for success. They should be thick enough to exclude cold winds, but must allow sufficient sunshine and air, or the young growth is much retarded. Taking a thousand acres of beech wood in the Chiltern Hills district, it is found that the net yield of the beech, if well managed, will produce about twice the revenue of the adjoining arable land. The average gross yield per acre varies from 15s. in the worst woods to over £2 per acre in the best managed woods. The price of beech in the Chiltern Hills district varies from 8d. per cubic foot to about 2s., with an average of about 1s. to 1s. 3d.

Larch firs are a valuable revenue in plantation. They cost from £6 to £10 per acre for planting and fencing, and on fairly good soil will yield from £80 to £120 per acre when cut down at maturity in from 60 to 80 years, besides the value of thinnings meanwhile. It has been found that some larch plantations have paid a profit representing a steady revenue of from £3 to £4 per acre from the time of planting to the final cutting.

It would be very desirable to encourage more extensive planting of woodlands on soils which are now practically waste or unfit for farm purposes. Landowners are naturally averse to the expenditure of capital which will produce no return for at least 20 to 30 years.

There are probably three ways in which such planting to the national and local advantage might be promoted :—

(1) By encouraging landowners to obtain loans on easy terms for approved expenditure in planting.

(2) By relieving all new plantations for, say, 25 years from the payment of rates, there being no beneficial ownership until after such period unless occupied or let for sporting purposes.

(3) By improved methods of teaching forestry and facilities for woodmen to acquire information, which, together with increased advantage of easy transit, would encourage owners and add to the value of timber culture.

APPROXIMATE VALUES OF TIMBER, 1902.

		s.	*d.*		
Oak under 15 feet		1	3	per cubic foot.	
„ 15 to 20 „		1	8	„ „	
„ 25 to 50 „		2	–	„ „	
„ 50 feet and upwards		2	6	„ „	and upwards.
Ash under 15 feet		1	–	„ „	
„ 15 to 25 „		1	6	„ „	
„ 25 feet and upwards		2	–	„ „	
Elm under 15 feet		–	6	„ „	
„ 15 to 25 „		–	9	„ „	
„ 25 feet and upwards		1	–	„ „	
Beech under 15 feet		–	9	„ „	
„ 15 to 25 „		1	–	„ „	
„ 25 feet and upwards		1	6	„ „	
Larch Fir	9*d.* to	1	2	„ „	
Scotch Fir	6*d.* to	–	9	„ „	
Spruce Fir	4*d.* to	–	6	„ „	
Spanish Chestnut		1	6	„ „	and upwards
Horse „		1	–	„ „	„
Walnut		2	–	„ „	„
Lime		1	6	„ „	„
Hornbeam		2	–	„ „	„
Sycamore		1	6	„ „	„
Willow		1	3	„ „	„

Appendix IX.

Plane	1	–	per cubic foot and upwards.
Poplar, Italian (black)	–	10	„ „ „
„ Lombardy		3	„ „ „
Birch	1	–	„ „ „
Maple	–	9	„ „ „
Cherry	–	9	„ „ „
Acacia	1	–	„ „ „
Box	2	6	„ „ „
Holly	2	–	„ „ „

MALLARDS COURT TIMBER, STOKENCHURCH.

Date.	Sale Amount.			Average Price per Load of 25 feet.	
	£.	s.	d.	s.	d.
December 1889	266	3	5	23	–
„ 1890	398	19	2	31	–
January 1892	168	12	6	24	9
December 1892	220	16	7	24	6
November 1893	156	9	10	16	6
December 1894	136	17	1	19	3
„ 1895	143	7	8	20	3
„ 1896	201	17	3	25	6
„ 1897	182	13	2	25	–
„ 1898	145	3	11	22	6
„ 1899	156	6	3	20	6
„ 1900	238	18	9	26	6
„ 1901	100	5	5	19	3
	13)2,518	11	–	13)298	6
Average per annum - £.	193	14	8	23	–

Showing an average return of 2*l*. 0*s*. 9*d*. per acre per annum from 95 acres.

KING'S WOOD TIMBER, HIGH WYCOMBE.

Date.	Sale Amount.			Average Price per Load of 25 feet.	
	£.	s.	d.	s.	d.
December 1882	517	10	3	22	6
„ 1883	297	12	9	19	
„ 1884	336	19	2	23	–
„ 1885	269	4	–	28	–
„ 1886	232	17	–	18	6
„ 1887	131	2	10	19	–
November 1888	116	4	3	19	3
February 1891	296	12	–	31	9
December 1892	198	9	4	27	–
„ 1894	183	6	3	12	9
November 1897	486	3	11	22	9
January 1900	121	14	3	20	–
December 1900	164	13	2	21	6
„ 1901	126	18	2	22	–
	20)3,479	7	4	14)307	–
Average per annum - £.	173	19	4	22	–

The area of the woodlands on the estate is as follows :—

	a.	r.	p.
Plantations in Wycombe and Penn	71	0	29
King's Wood and Common Land	188	1	2
Gomms Wood	11	2	5
Little Gomms Wood	3	1	14
	274	1	10
Deduct for Common	18	3	30
	255	1	20

Showing an average return of 13*s*. 7*d*. per acre per annum; or, deducting the plantations and some waste land, about 1*l*. per acre per annum.

QUEEN'S WOOD TIMBER, WATLINGTON.

Date.	Sale.				Average Price per Load of 25 feet.	
	£.	s.	d.		s.	d.
February 1883 - - - - - - -	485	7	9		19	6
" 1884 - - - - - - -	328	16	8		19	3
" 1885 - - - - - - -	323	11	7		16	6
" 1886 - - - - - - -	192	14	6		12	6
" 1887 - - - - - - -	187	16	–		13	9
December 1888 - - - - - -	192	10	10		10	3
" 1889 - - - - - - -	306	1	3		18	6
" 1890 - - - - - - -	390	6	–		26	6
" 1891 - - - - - - -	200	18	11		16	3
March 1893 - - - - - - -	346	13	8	mostly Oak	14	–
January 1894 - - - - - - -	650	12	5		16	6
" 1895 - - - - - - -	136	4	2		16	6
" 1896 - - - - - - -	405	12	5		21	6
December 1896 - - - - - -	366	16	7		21	9
January 1898 - - - - - - -	165	14	5		15	3
" 1899 - - - - - - -	130	4	10		18	–
February 1900 - - - - - - -	179	12	8		16	–
" 1901 - - - - - - -	266	–	6		18	–
" 1902 - - - - - - -	186	7	9		18	3
	20)5,402	2	11		19)326	[illegible]
	270	2	2		Average price 17 3 per load.	

Or an average of 1*l.* 7*s.* per acre per annum from 200 acres.

STUDDRIDGE TIMBER, STOKENCHURCH.

Date.	Sale.				Average Price per Load of 25 feet.	
	£.	s.	d.		s.	d.
December 1882 - - - - - - -	493	18	9		32	–
" 1883 - - - - - - -	403	12	9		26	6
May 1884 - - - - - - - -	355	13	11	Oak and Larch.	—	
December 1884 - - - - - - -	355	15	–		26	–
" 1885 - - - - - - -	346	16	10		21	6
April 1886 - - - - - - - -	511	6	9	Larch	—	
January 1887 - - - - - - -	252	8	5		20	6
December 1887 - - - - - - -	161	–	8		13	9
" 1888 - - - - - - -	258	19	11		18	6
" " - - - - - - -	685	3	10	Larch	—	
" 1889 - - - - - - -	606	17	4		—	
" 1890 - - - - - - -	174	13	9	mostly Ash	28	–
January 1892 - - - - - - -	219	18	8		27	–
December 1892 - - - - - - -	379	19	10		34	3
November 1893 - - - - - - -	308	17	8	Larch.	—	
December 1894 - - - - - - -	215	2	1		23	
" 1895 - - - - - - -	244	18	8		22	9
" 1896 - - - - - - -	389	19	5		27	6
" 1897 - - - - - - -	495	15	11		24	–
" 1898 - - - - - - -	204	15	11		29	–
" 1899 - - - - - - -	321	5	7		27	9
" 1900 - - - - - - -	221	19	7		30	3
" 1901 - - - - - - -	120	14	2		18	3
	20)7,729	15	5		18)450	6
Average per Annum - - - - - -	386	9	9		25	–

Showing an average return of 2*l.* 0*s.* 0*d.* per acre per annum from 193 acres.

Appendix IX.

HUGHENDEN ESTATE, HIGH WYCOMBE.

Date.	Amount of Sales.			Average Price per Load of 25 feet.	
	£.	s.	d.	s.	d.
November 1882	559	16	–	30	9
„ 1883	675	19	5	37	6
December 1884	504	18	8	33	6
„ 1885	397	15	10	35	6
„ 1886	288	3	1	24	6
„ 1887	234	13	6	24	6
November 1888	380	10	6	24	3
December 1889	348	11	–	37	3
„ 1890	482	2	2	45	–
„ 1893	576	12	8	28	–
January 1895	374	3	2	27	–
„ 1897	351	1	2	28	6
February 1898	1,429	13	1	26	3
March 1900	865	4	8	31	3
„ 1901	489	19	4	27	3
	20/7,959	4	3		
Average per annum	397	19	2		

Showing an average return of *2l.* 1*s.* 10*d.* per acre per annum from 191 acres.

Appendix X.

APPENDIX, No. X. (Q. 2540).

HANDED IN by Mr. DUDLEY W. DRUMMOND.

I have for 14 years been managing landed property in the counties of Carmarthen and Cardigan, and am at present agent for the following estates:—

——	Total Area.	Woodland Area.
Cawdor	62,096 acres	2,100 acres.
Edwinsford	10,700 „	695 „
Derllys	3,162 „	75 „
Glandenys	5,000 „	83 „
	80,958 acres	2,953 acres.

comprised in 48 parishes in the above counties.

Although I have had opportunities of observing the system of sylviculture in many parts of England and Scotland, and to some extent on the Continent, my evidence will deal more particularly with that prevailing in South Wales, and notably in Carmarthenshire.

The elevation of the lands under my management range from the sea level to the upland pastures of some 1,500 feet, and the geological formations are those of the coal measures, carboniferous limestone, and old red sandstone on the east of the county, and the lower Llandovery Rocks, and argillaceous shales, and conglomerate beds on the west.

The rainfall varies from 35 to 50 inches. The agricultural rents range from 15s. to 25s. on the low ground farms, 10s. to 15s. on the upland, and 3s. to 5s. on the hill farms.

The principal plantations in Wales consist, among the soft woods, of larch, Scots pine, and spruce, and among the hard woods of oak, elm, ash, beech, alder, and sycamore, which form the older mixed woods. Practically no hard woods are ever planted now, which is a matter of much regret, and larch occupies by far the greatest area of woodland, owing to its early maturity for the pit-wood market, where it finds a ready sale in the extensive and progressive colliery undertakings in the east of the county, and thence in that direction to the Glamorganshire coalfield.

The average value per cubic foot obtainable on the ground is as follows:—Oak, 8d. to 1s.; ash, 8d. to 1s.; beech, 5d.; sycamore, 6d.; spruce, 5d.; larch, 9d.; elm, 8d.; alder, 7d.; Scotch pine, 6d.; and the felling prices average from 1s. 3d. to 1s. 6d. per ton of 40, and the haulage from 1s. 3d. to 1s. 6d. per ton, per mile, according to the nature of the roads.

The principal outside markets for timber trees are the industrial midland districts, Wigan, Darlaston, Manchester, while the pitwood is mostly disposed of locally. In this, as in all branches of the timber trade, the home produce suffers severely from foreign competition. The local collieries are very largely supplied with French and Swedish pit-wood, there having been as much as 4,500 tons imported into the small port of Llanelly alone last year.

The railway rates on timber are very high, ranging from 5s. 7d. to 12s. 2d. within the county confines, and equalling the shipping, insurance and dock rates combined from the Baltic ports, and exceeding them considerably to the midland districts.

The poor rates in the county vary from 3s. to 5s. in the £, and when to these are added the Income Tax Schedules A and B, Land Tax, Tithes, Estate Duty, and extraordinary traffic charge, a further discouragement is thrown upon planters.

The lands under wood are rated on the average at 10s. per acre for parks, 7s. 6d. per acre for low grounds, 5s. per acre for highlands, and the collective rates and taxes must be between 7s. and 8s. in the £. Further, to cap the difficulties from which we suffer are the continuing high price, scarcity and poor quality of the labour obtainable, and it is thus not surprising that the percentage area of our woodlands is so small and their general maintenance so defective.

In Wales in particular there is great mismanagement and an enormous unproductive area, which could profitably be planted and largely increase the value of its resources, and greatly improve the surrounding lands by shelter, and I should like to see a large afforestation scheme carried out on the Continental system, as there is something very incongruous in the appearance of the bare mountain sides of Wales, in the vicinity of collieries and ports where thousands of tons of pit-wood are annually imported.

With the increasing shortage of available timber at home and abroad owing to constant felling and inadequate replanting, the distant future prospect of forestry is anything but hopeful, but those proprietors who have growing plantations in hand and have the energy and foresight and means to extend their wood-

Appendix X.

land areas, will, I am confident, reap increasing values and good returns in the future.

The future successful prospects depend entirely on the early recognition by public and private proprietors of the importance, for their own country's sake, of extending and conserving their woodlands, and public means should be adopted to impress this upon them.

As I have previously stated, larch and fast growing conifers are the order of the day, and there is very little intelligence shown as to the selection of trees for particular situations, and a lamentable mismanagement generally in their subsequent treatment.

Early return in this and all other products of land culture is only considered, and thus the replanting of hard woods is almost entirely unknown.

It is only the largest estates that possess any apology for a system or even a forest staff, and most of the woods that are felled are left to nature to restore. On the Earl of Cawdor's Estate I am enabled to do a good deal, as there exist a systematic staff, and a four acre nursery garden, from which some 90,000 forest trees are issued annually. I quickly replant the felling areas, and extend them whenever opportunities arise.

There is, however, no systematic working plan such as is prevalent in the Continental forest departments, as, owing to the small and very scattered nature of the plantations many difficulties to such course would arise.

The planting on this estate is done entirely by our own staff, and with excellent trees grown in our own nursery, from seed in some instances collected from our own plantations, and in others purchased from Scottish firms. The smaller estates generally purchase plants from the well known seedsmen, and they are planted, as a rule, by very incapable hands. Occasionally there are to be found small local nurserymen who raise and plant trees by contract, and the rates vary from £3 to £5 per acre, according to the quality of the trees and nature of the ground.

Were the Board of Agriculture to publish an elementary handbook on forestry and issue leaflets, calling attention to the great importance of planting and the principles and methods which underlie the planting of various classes of timber trees, I believe much good would ensue. The present publications are too lengthy, abstruse, and scientific, for any but learned experts to follow.

The Land Improvement Company could also bring home by similar methods to proprietors the urgency of the subject, and advertise more fully their loan systems.

Adequate training of foresters and woodmen is another necessity.

It being a national question, the Government should either remit the rates and taxes of woodlands until such time, at any rate, as a profit is shown upon them, or give a bounty to encourage the promotion of afforestation.

Much might be done also by co-operation among proprietors with the object of getting into new markets a readier means of conversion of timber and its waste products, which are not lost sight of abroad.

In 1900, 9,899,686 loads (value £25,873,564), and in 1901, 9,193,934 loads (value £22,501,010) of timber, were imported into the United Kingdom, which shows the enormous demand that exists in, and loss of money to, our country. The imports have steadily risen in amount and value during the past five years, and exceed £10,000,000 worth increase during that period.

That timber still does pay when properly grown, and is likely to further do so in the future, I have no doubt; but the great risks that attend it, and the long period before any dividend on the initial outlay is obtained, the uncertainty of modern legislation, and the present uncontrolled expenditure by local authorities which falls upon the land, all militate against its success.

Few dependable profit and loss accounts on individual woodlands are kept in England, and the many I have seen I have always considered somewhat illusory; but that it is a paying crop now, and likely, under advanced treatment, to be still more so, I have little doubt, and I have long held that many Welsh farms, at any rate, would be more profitable to a proprietor under wood than agriculture.

People who practice forestry, so far as my experience goes, seem to have less technical knowledge of their subject than those engaged in any other profession, and at least an elementary training is much needed. As to its details, I rather question the advisability of forming a separate State School of Forestry—the area of our national woodlands (3,034,611 acres) hardly seeming to justify this, and the difficulty that obtains in locating it in a district giving facilities for practical experiments and teaching which would be applicable to the various conditions of forestry in these isles. I believe better results could be obtained by giving special and distinct education at some of the existing agricultural colleges or local universities, such as Cirencester, within access of the Forest of Dean, where a regular and apparently very successful forestry system has been adopted; Downton, near the New Forest, where perhaps a similar condition of things may be adopted, and where, at any rate, there is a good field for practical demonstration, and similar centres in Scotland and Ireland.

The Government should be asked to subsidise these centres upon the basis of results obtained under their own examinations.

A long course of, say, 18 months might be adopted, as well as short courses of three months, with an examination at the end of each, and the subjects might be divided thus:—

1st Month.	2nd Month.	3rd Month.
Elementary. Geology. Botany. Entomology.	Surveying. Mensuration. Book-keeping.	Sylviculture. Formation of Woods and Practical work.

These should be somewhat on the lines of the Army technical short courses which are so successful. Facilities should also be given for visits of inspection to Continental forests.

The long courses could be taken up by young men making the subject a profession, while the shorter courses, especially if taken by months at a time, would be available to the greater number of men in practice in various professions connected with the land, and be, I believe, a source of great benefit to the future of forestry.

APPENDIX No. XI. (Q. 2683).

Appendix XI.

Handed in by Mr. Alexander Pitcaithley.

In the absence of any method in the management of the woods on most of the estates of Scotland, and to my knowledge some parts of England, it is practically impossible to give a perfectly accurate result of the growing of timber, I am not aware of any existing wood where a correct record of the outlay in forming and tending, afterwards giving the value of thinnings, etc., until cleared, has been kept.

There is abundant evidence, however, to prove that timber growing, even in the imperfect way it has been done, especially during the past century, has given in many cases a handsome profit. It is at the same time evident that with a proper sylvicultural knowledge in those who had the selection of the crop for certain particular soils and situations, and for the future management of the woods, the ultimate profits would have been considerably greater. I may be allowed to quote two cases from this estate (Scone). The first is an average case of mixed forest of larch, spruce, and Scots fir, ninety years of age, of which an area of some ten acres was cut last year, and realised £1,260, as it stood after quite one-fourth of the crop had been removed in thinnings, and cut out for fencing purposes, etc. It may be assumed that after deducting price of planting, upkeep

Appendix XI.

and interest on outlay it left about 25s. per acre per annum. The larch it contained was what principally enhanced its value. Upon other portions of Scone estate there are larch woods of much greater value per acre, but owing to the spread of the larch disease rendering the growing of larch unremunerative I will not refer to these.

The other case I would quote was a section of wood 110 years of age, containing 960 Scots firs and 40 larch, which was sold as it stood for almost £1,500, or at the rate of about 30s. per tree, the average distance apart of these, where the plantation was entire, being about 16 feet, the area occupied by trees being approximately about six acres, giving a result of £2 10s. per acre per annum, and this on ground worth only a few shillings per acre as grazing. These results, instead of being unfortunately the exception, might have been, with a better knowledge of forestry, vastly improved.

With very few exceptions all over the country, one finds a very different picture—gappy woods, stunted growth, short course stems standing far apart, which, when cut down and cleared away, prove "defunct debtors."

It is undeniable that there has been and yet exists a general ignorance in the profitable growing of timber crops, even in such fundamental points as the following. To what extent draining is necessary for the varieties proposed to be planted, what species to grow on various soils, etc., whether to plant pure or mixed—if pure, what variety and how close to plant; if mixed, what varieties and what proportions of varieties, when and how often to thin, and when to realise the crop. It often occurs also that when the owner wishes to sell his mature timber he runs a risk of not getting its full value, as comparatively few foresters are reliable in the valuing of standing timber, and it not unfrequently happens that only half the value is offered for a lot by a timber merchant. There are also the questions of underplanting, wind screens, diseases, and pests of forest trees, that can only be demonstrated in the forest, and which foresters hitherto have had little if any chance of acquiring a knowledge of. We now possess some proof of how pine or spruce should be grown, and also some proof that Continental principles are quite applicable to this country. We have an object lesson in the old Scots fir on Scone estate which are 120 years of age, they were grown dense until they attained their full height, and now contain over 100 cubic feet of timber each, many of the trees having a clear stem of over 60 feet. It is questionable if better fir can be seen in Europe—and this is mainly if not entirely due to what was considered the *neglect* of the plantations. While we may be said to generally accept the Continental system in growing coniferous woods, it is not so certain how best to treat hard woods, or indeed if hard woods can be grown to profit in most parts of Scotland, also how the planter is to discriminate between the suitability of a certain area for hard woods or coniferous planting.

The foregoing are only a few of the points that we foresters have all along felt our lack of knowledge of, and made us unable to confidently advise or carry out work with credit to ourselves and profit to our employers and the country generally.

While this want of forestry education may be considered the principal cause of the unpopularity and comparatively unprofitable state of forestry in this country, it must be admitted that there are other causes, such as the over-thinning of young plantations, and cutting down immature woods when a good price was offered for prop wood, or when it was considered necessary to get some income from the plantations, by which heavy thinnings the remaining crop was reduced to a condition that would permanently make it unprofitable, though the acreage remained the same.

Another and more generally important factor against forestry is the game question, especially roedeer, hares, and rabbits. If the system of forming warrens was adopted it might be to the benefit of both the forest and game departments, otherwise the only effectual remedy is wire and wire netting, which often doubles the expense of formation of plantations.

A fair estimate of the expense of planting might be as follows, per acre on ordinary hill ground without draining, using two years, one year Scots fir (which is the best size), placed 3½ feet apart, plants and planting £2 10s., or, if carriage is heavy, £2 15s.; wire netting and fencing will come to as much, except the area be on easily fenced ground, and almost square in shape; draining may be anything, according to the nature of the ground, and it is an undecided point the limit at which draining will pay.

To teach forestry effectually it is essential that a State forest be provided, where instruction and illustration would be provided of the best methods of raising timber crops under our conditions of soil and climate, and to act as an object lesson in sylviculture and systematic management to proprietors and foresters throughout the country, without which there is no chance of settling the disputes and dissensions about the application of Continental principles to this country, and no model to which foresters can shape their management, and no other way whereby experiments could be carried out with the continuity that is necessary.

Under good management it can scarcely be denied that land drawing less than, say, 10s. per acre for grazing purposes, would give a far better account of itself under wood, and land of this value would suit as a forest area, provided it was near a railway or sea coast, or both.

It must be borne in mind, however, that over the most of the Highlands of Scotland at least, the sporting value of heath land exceeds largely its grazing value, sometimes as much as six times, and where the sporting value is three or four times more than its grazing value, it would not pay to plant; but, as a general rule, where the sporting value is small and the grazing value moderate it would certainly pay. The necessity of improving our system is obvious when we see the foreigner supplying our markets with a better article than we have hitherto been producing; while, under our system, we have produced an article of inferior quality that can only be used for certain purposes as a third or fourth rate timber, when under other treatment it might excel any foreign timber, and certainly could be produced in greater bulk on less ground than that on which we grow our inferior timber.

Appendix XII.

APPENDIX No. XII. (Q. 2832)

Handed in by Mr. J. Maxwell.

Rating of Woodlands in Scotland.

There are two distinct and separate steps in connection with assessment to local taxation in Scotland: (1) the valuation of the subjects, and (2) the imposing and levying of the rates. These steps will be considered separately.

1. Valuation.

17 & 18 Vict c. 91, sec. 6 & 42. Allan v. Dunlop, 9 Oct. 1858, 20 D. 1354. Lord Forbes, 26 Nov. 1861, 24 D. 1458. 49 Vict. c 15, sec. 6

Woodlands are valued upon the rent at which, in their natural state as pasture or grazing lands, they may reasonably be expected to let from year to year. Where the woodlands have also a shooting value, such value is fixed separate from, and in addition to, the value as "pasture or grazing lands."

Prior to 1886, shootings and deer forests were only valued when actually let, but in that year this proviso in their favour was repealed, and these subjects are now valued even when not let. 17 & 18 Vict. c. 91, sec. 42. 49 Vict. c. 15, sec. 4.

The value of lands and heritages is assessed by the assessor, who may call for written statements of rent from the proprietor or tenant or occupier, and, where a subject is not let, may value it at such rent as he may deem to be the yearly rent or value. The assessor prepares the valuation roll on or before 15th August in each year. On 8th September the roll is transmitted to the county clerk or town clerk, as the case may be, and is thereafter open for the inspection of any person interested. Any appeal or complaint against an asses- 17 & 18 Vict. c. 91, sec. 7. 17 & 18 Vict. c. 91, sec. 4. 17 & 18 Vict. c. 91 sec. 11. 42 & 43 Vict. c

42. secs. IV. & V. 58 & 59 Vict. c. 41. sec. 5. 30 & 31 Vict. c. 80. sec. 7. 17 & 18 Vict. c. 91. sec. 8. 20 & 21 Vict. c. 58. sec. 2. 30 & 31 Vict. c. 80 sec. 8. 42 & 43 Vict. c. 42. sec. 7.

sor's valuation may be made in the first instance to the Valuation Appeal Committee in counties or to the magistrates or a committee appointed by them in burghs not later than 10th September. The Appeal Court is held between 10th and 15th September, and the appeals and complaints must be disposed of by 30th September, the roll being altered in accordance with the decisions of the Court. An appeal from this first Court may be taken on a stated case to two Judges of the Court of Session, sitting as a Lands Valuation Appeal Court, whose decision is final.

In all the counties of Scotland, except nine, the assessor is an officer of Inland Revenue. It frequently happens also that the assessor in burghs is an officer of Inland Revenue.

Woodlands, where they have a shooting value, are entered in the valuation roll (1) at their grazing value, and (2) at their shooting value.

2. Imposition of Local Rates.

Rates are imposed and levied by three different authorities * in Scotland: (1) Parish authorities, (2) county authorities, and (3) burgh authorities.

(1) Parish Authorities.

8 & 9 Vict. c. 83, sec. 37.

Parish rates are levied upon an annual value, being the gross value as appearing in the valuation roll under deduction of the probable annual average cost of repairs, insurance, and other expenses, if any, necessary to maintain such lands and heritages in their actual state, and all rates, taxes, and public charges payable in respect of the same. These deductions are fixed arbitrarily by Parish Councils—10 per cent. possibly being given off land, 20 per cent. off houses, and 33 per cent., or even more, off railways. The deductions, however, vary considerably in different parishes. Sometimes in rural parishes or in town parishes it is the practice of Parish Councils to give uniform deductions; and there are cases in which no deductions at all are allowed, the rates being imposed upon the gross rental.

8 & 9 Vict. c. 83, sec. 36. 24 & 25 Vict. c. 7.

59 & 60 Vict. c. 37, sec. 5. 59 & 60 Vict. c. 37, sec. 1.

A unique feature in rating is the classification of subjects for occupants' rating. Power was given to make such classifications under the Poor Law Act of 1845, and when assessment according to means and substance was abolished by the Baxter Act of 1861 a classification approved by the Board of Supervision was made compulsory in the twenty-two parishes affected. Classification has been described as "a rough method of adjusting the assessment to the taxable capacity of the ratepayer." Under the system of classification, the main object secured was the adjusting of the burden upon subjects of trade, such as shops, quarries, manufactories, and farms. Thus, shops and manufactories might be rated at one-half, and lands at one-third or one-fourth of the rate upon houses. Under the Agricultural Rates, etc., Act, 1896, no classifications other than those certified under the Act have any force or effect, and a classification is not certified by the Secretary for Scotland unless the rates leviable on the occupiers of agricultural lands and heritages in pursuance of the classification are less than, or as nearly as may be the same as, the rates which would without classification be leviable on such occupiers in terms of the Act. The power of parishes now to classify is suspended, but a certified classification may be abandoned by a Parish Council.

Appendix XII.

There are 875 parishes in Scotland; in 76 a classification is at present in force. Of these, 18 specially provide for the assessing of woodlands or shootings. In 16, woodlands or shootings are more favourably treated than if no classification existed, and in the remaining two they are less favourably treated. It would appear that, of the 58 parishes having a classification in which special provision is not made for woodlands or shootings, 35 are treated more favourably than if not classified, and the remaining 23 are less favourably treated.

59 & 60 Vict. c. 37, sec. 1.

Seven hundred and ninety-nine parishes † have no classification of occupants, but agricultural subjects are rated upon three-eighths only of the annual value. Woodlands are expressly excluded from the term "agricultural lands and heritages," and are therefore rated upon the full annual value.

All parish rates are levied in the same manner as the poor rate, equally upon owner and occupier—*i.e.*, one-half of the amount required is, as nearly as may be, collected from owners, and the other half, under deduction of the amount received from the Agricultural Rates Grant, is collected from occupiers.

The rate per £ falling upon owners is not infrequently different from that falling upon occupiers, the variation being due chiefly to the fact that the Agricultural Rates Grant being a fixed sum, will, in the case of an increasing rate, be insufficient to meet the five-eighths' relief to agricultural occupiers, and, in the case of a decreasing rate, may be more than sufficient to cover that relief.

(2) County Authorities.

52 & 53 Vict. c. 50 sec. 27 (4).

Govan Police Comrs. v. Armour, 3 Feb. 1887, 14 R. 461.

County rates are levied upon the gross rental as appearing in the valuation roll, agricultural subjects being rated upon three-eighths of that rental. Woodlands are rated upon the gross rental. With regard to the incidence of the county rates, an average of ten years' rates was taken for those rates which, prior to 1889, had been imposed wholly upon owners, and that average now forms a stereotyped rate, which is paid wholly by owners. Any rate required over and above that average rate is imposed equally on owners and occupiers. The rates which are thus stereotyped in whole or in part are: the county general assessment, the county police rate, the Sheriff Court Houses rate, the lunatic asylums rate, the registration of voters rate, the Militia storehouses rate. The other rates, viz., the public health and special water and drainage district rates, special lighting and scavenging district rates, diseases of animals rate, housing of the working classes rate, road rate (excepting old road debt, which is wholly on owners), county general purposes rate, allotments rate, and light railways rate, and valuation of lands rate (where separately levied and assessed by the county) are imposed one-half on owners and one-half on occupiers, but, unlike the parish rates, it is one-half of the rate per £ which is imposed on owners and occupiers respectively.

(3) Burgh Authorities.

55 & 56 Vict. c. 55. sec. 340. 55 & 56 Vict. c. 55. sec. 347.

Burgh rates are levied on the gross rental as appearing in the valuation roll, certain subjects, including woodlands, being rated on one-fourth of the gross rental.

APPENDIX No. XIII. (Q. 2867).

Handed in by Major P. G. Craigie.

(A).—Note on the Board of Agriculture's powers with reference to Loans for Planting.

Loans for planting under the Improvement of Land Acts may, at the present time, be charged on estates, under like conditions as regards inspection and sanction by the Board of Agriculture to those for other works of improvement. These charges are subject to the maximum period of 40 years. This maximum has only been permitted since the passing of the Improvement of Land Act, 1899, which enlarged the limit of 25 years formerly enforced by statute, but charges "in respect of the planting of woods or trees" created either before or after the passing of the Act of 1899 for less periods than 40 years, may, on the application of the

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* Certain ecclesiastical rates are imposed by heritors; and District Fishery Boards also rate the subjects within the Fishery Board areas, but these rates are unimportant, and are not dealt with.

† In five of these parishes no rate is levied for relief of the poor, the funds being provided otherwise.

Appendix XIII.

landowner, not sooner than 7, nor later than 10 years from the date of the absolute order creating the charge, and, with the consent of the persons entitled to the charge, be extended at the discretion of the Board to the maximum of 40 years.

Planting was not one of the earliest objects contemplated by the series of Acts regulating charges for land improvements. The original grants of public money applicable to improvements were limited to drainage works under the Public Money Drainage Acts, 1846-1856; but in the subsequent Private Money, or "Companies" Acts, "planting for shelter to the extent of one-half of the outlay for such planting," was recognised as an improvement in the Lands Improvement Company's Act, 1853 (Sec. 6).

By that Company's Act of 1855 (Sec. 4) this provision was, however, repealed and replaced by a more extended authorisation which dropped the one-half limit and allowed "planting for shelter or for periodical cuttings which will increase the permanent value of the land and shall be approved by the Inclosure Commissioners."

A further extension was secured by the same Company's Act of 1859 (Sec. 3), which substituted "planting for shelter or for any beneficial purpose which will increase the permanent value of the land." The Scottish Drainage and Improvement Company's Act, 1856 (Sec. 4), allowed "Planting for shelter or for periodical cuttings which will increase the permanent value of the land," a phrase which was again extended by the same Company's Act of 1860 (Sec. 4) to "Planting for shelter or for any beneficial purpose which will increase the permanent value of the land," and the same terms are used in the Land Loan and Enfranchisement Company's Act, 1860 (Sec. 11).

Apart from this legislation as to the powers of private companies, the general "Improvement of Land Act, 1864," included (Sec. 9, Item No. 9) among the list of improvements the item of "planting for shelter." This statute contained a proviso (Sec. 15) that the requisition as to increased annual value should not apply to any outlay proposed to be made upon or in respect of planting. The Act was applicable to Great Britain as a whole, but so far as England was concerned the Settled Land Act, 1882, in extending the schedule of statutory "improvements" enlarged the definition of "planting" (Sec. 25), by removing the qualifications as to shelter above quoted. By the passing of the Improvement of Land (Scotland) Act, 1893, which was eventually repealed and re-enacted by the Improvement of Land Act, 1899, Scotland had, however, extended to it the same latitude in cases under the general Act of 1864 as England enjoyed in the matter of planting under the Settled Land Act, the term employed in defining the improvement being "Planting of woods or trees."

The latest amendment of the law, effected by the Improvement of Land Act, 1899, enlarged the maximum term of charge to 40 years (Sec. 4), extended all the Settled Land Act list of improvements to Scotland (Sec. 2), and by Sec. 3 enabled any improvement in that list to be carried out under the Private Companies Acts, if it had been authorised by these Acts.

As regards practice under the Acts above referred to, the total amount of money charged upon land in Great Britain in respect of planting up to the 31st December, 1901, has been £98,212 0s. 5d. The expenditure charged on estates in each of the last five years was as under:—

Year.	Amount Charged. £	s.	d.
1897	2,402	12	1
1898	119	12	0
1899	86	12	6
1900	1,100	17	5
1901	529	15	8

Since the passing of the Act of 1899 nine cases have arisen where charges in respect of planting have been sanctioned by the Board. It may be added that no application for the extension of a charge for planting to a longer period of years than had already been granted has been made to the Board.

Appendix XIV.

APPENDIX No. XIV. (Q. 2887).

Handed in by Major P. G. Craigie.

(B). Returns of Woods.

In 1871 a special return was obtained of woods, coppices, and plantations (excepting gorse land and garden shrubberies), the acreage being ascertained by the occupier's schedule, on the ground that "woods are information available in their respective districts. The information was not obtained through the medium of the occupiers' schedule, on the ground that "woods are not often held by farmers." In the following year the collecting officers were instructed to examine the first returns with the view of testing their general accuracy, and the figures, revised accordingly, were re-published in the Agricultural Returns for 1872, the total acreage for Great Britain (excluding the Isle of Man and Channel Islands) as amended, appearing as 2,187,078 acres.

A similar return was obtained in 1880, and in connection therewith it was explained that considerable difficulties were met with in obtaining the information, as, besides the examination of rate-books, valuation lists, etc., special application had frequently to be made to the proprietors of woods, and there was often some doubt as to what land should be included in the return. It was stated that the figures were believed to be generally accurate but they were, nevertheless, amended in the following year, as the result of further enquiries which led to the addition of nearly 50,000 acres, bringing up the total area for Great Britain (excluding Isle of Man and Channel Islands) to 2,458,300 acres.

The next return was obtained in 1888 and the difficulties of securing accuracy were again referred to. The result was to show an increase during the seven years since 1881 of over 100,000 acres and to raise the total area for Great Britain to 2,560,744 acres.

It appears evident, however, that all these returns were more or less defective, and that conclusions based upon their results could not be considered to be reliable.

In 1891 the attention then being directed to the question of forestry led to the institution of a more exhaustive enquiry on somewhat extended lines. A distinction was made between "woods" and "plantations," the latter term being confined to areas planted within the previous decade. Direct personal application was made to the holders of wooded land by means of the occupiers schedule, and in many instances corrected measurements were obtained from the Ordnance Survey maps. A distinction was also made between woods and plantations on the lands of the owners and those which were occupied by tenants. As a result of the improved methods of enquiry no close comparison with previous returns is possible, but the total figures for Great Britain amounted to 2,694,575 acres, of which 102,671 acres were plantations made during the preceding 10 years. Returns were for the first time obtained from the Isle of Man and the Channel Islands.

In 1895 a further return was obtained, the methods of collection adopted being similar to those employed in 1891. It was not claimed that even these results were absolutely free from error, the difficulties arising from varying interpretations of the term "Wood" being in themselves sufficient to preclude precise accuracy, particularly in making comparisons with previous returns. But it was considered that the areas of woodland shown by this return were in fact a closer approximation than had been previously available.

The total extent of woodland in Great Britain was returned as 2,726,116 acres, of which 131,843 acres were planted since 1881. From this it appeared that 29,172 acres had been planted since the returns of 1891 were collected. As, however, the total increase of the area of Woods and Plantations during the four years slightly exceeded this figure, it is evident that the return of 1895 must have been somewhat more exhaustive than that of 1891, and still more, therefore, than those which preceded it.

Appendix XIV.

SCHEDULE.

Returns for woods, coppices and plantations were first obtained in 1871. *See* pp. 6 and 7 of the report of that year, and pp. 26 and 51-59 of the tables (C. 460).

In 1872 the figures obtained in 1871 were tested as to their accuracy and republished. *See* pp. 10 and 11 of the report, and pp. 64 and 65 of the tables (C. 675).

In 1880 a special return was again obtained. *See* p. 5 of report for that year, and pp. 46 and 47 of the tables (C. 2,727).

In 1881 the figures collected in 1880 were amended and republished. *See* pp. 6 and 7 of the report, and pp. 52 and 53 of the tables (C. 3,078).

In 1888 a special return was made. *See* pp. 11 and 12 of the report, and pp. 76 and 77 of the tables (C. 5,493).

In 1891 a return was called for in which woods were distinguished from plantations. *See* pp. 8 and 9 of the report, and pp. 48-51 of the tables (C. 6,524).

In 1895 the last return of the woods and plantations was obtained. *See* pp. 8 and 9 of the report, and pp. 36 and 37 of the tables (C. 8,073).

So far as the figures may be regarded as comparable, the table below supplies a summary of the whole of the returns which have been obtained :—

WOODS AND PLANTATIONS.

—	1871 as Amended in 1872.	1880 as Amended in 1881.	1888.	1891.	1895.
	Acres.	Acres.	Acres.	Acres.	Acres.
England	1,325,765	1,466,038	1,518,321	1,613,849	1,665,741
Wales	126,823	162,786	167,573	174,967	181,610
Scotland	734,490	829,476	874,850	905,759	878,765
GREAT BRITAIN	2,187,078	2,458,300	2,560,744	2,694,575	2,726,116

Appendix XV.

APPENDIX No. XV. (Q. 3142).

HANDED IN BY MR. C. O. MINCHIN.

MEMORANDUM ON THE OFFICIAL PRACTICE AS REGARDS THE ASSESSMENT OF DEATH DUTIES IN RESPECT OF TIMBER AND WOODLANDS.

1.—*Succession Duty under the* 16 *and* 17 *Vict. cap.* 51.

Section 23 of the Succession Duty Act, 1853, provides that where any succession comprises timber, trees, or wood, not being coppice or underwood, the net proceeds of sale of such timber, etc., if exceeding £10 in any one year shall be charged with Succession Duty (according to the interest of the successor therein).

This is held to apply to bark stripped from the trees and sold, but it does not apply to standing timber sold with the property as a whole nor to the sale money of trees which were not growing on the property at the time when the succession occurred, nor (in practice) to timber sold by a purchaser who bought the property, with standing timber, from the actual successor, nor to timber used in fencing or repair on the property.

Coppice and other wood yielding a regular income collected yearly or at other definite intervals should be brought into the general account of the property as part of the annual value of the succession. In order to arrive at the net income * "necessary outgoings" have to be allowed. These comprise :—

Expenses of selling, felling, and drawing the timber, and of restoring fences, ditches, roads (or any special parish rate for this) injured by felling and drawing the timber, so far as these fall on the vendor.

Also the proportion of the general expenses of the property attributable to the growth of the timber actually sold, including such things as the woodman's wages, cost of keeping fences in order, mole catching, etc., so far as these have not already been allowed upon the general succession account.

Furthermore, it is the practice (based upon the decision in the case of the Lord Advocate v. the Marquis of Ailsa, 19 Sc. L.R. 28) if the woodland has been brought into the general succession account at an annual value based upon the assessment on the valuation roll, not on a mere waste value, to allow a set-off for this in the timber duty account.

The successor is at liberty to commute the claims for duty which might arise in his succession upon the basis of an estimate of the net moneys obtainable by him from the sale of timber, etc., during his life, in a prudent course of management of the property.

The practice as to succession duty chargeable on deaths after 1st August, 1894 (the Finance Act, 1894) is the same as that set out above if the successor is not competent to dispose; but if he is competent to dispose then by Section 18 of the Finance Act it is assimilated to the practice for the estate duty.

2.—*Estate Duty under the Finance Act,* 1894, *deaths on or after* 2nd *August,* 1894.

Section 1 of the Act charges estate duty upon the principal value of all property which passes or is deemed to pass.

Section 7 (5) defines the principal value as the price which in the opinion of the Commissioners (of Inland Revenue) the property would fetch if sold in the open market at the time of the death of the deceased, but as regards agricultural property this is modified by the following proviso :—

"In the case of any agricultural property where no part of the principal value is due to the expectation of an increased income from such property, the principal value shall not exceed twenty-five times the annual value as assessed under Schedule A of the Income Tax Acts after making such deductions as have not been allowed in that assessment, and are allowed under the Succession Duty Act, 1853 (16 & 17 Vict. c. 51), and making a deduction for expenses of management not exceeding 5 per cent. of the annual value so assessed." In official phraseology this is known as the "superior limit," and this term is hereafter used for the sake of brevity.

In section 22 (1) (g) of the Act, agricultural property is defined to mean agricultural land, pasture, and woodland, including such cottages, farm buildings, farm houses, and mansion houses (together with the lands occupied therewith) as are of a character appropriate to the property.

From the first there was considerable difficulty felt as to how the value of agricultural estates on which there happened to be woods was to be measured by the Commissioners. It was at first suggested that the rule as to the application of the "superior limit" applied only to the surface, and that it did not include the woods (though they are in law held to be a part of the soil which passes to the heir) any more than it did the growing crops, which are personal estate, and pass to the next of kin.

This view was adopted in dealing with a few estates which passed soon after the date of the Act, and the values were ascertained by adding to x times the net annual value of the surface (x not being greater than 25), the saleable value of all timber whether ripe for felling or not.

Upon further consideration, and after some discussion, the practice was modified, and the value ascertained by adding to x times the annal net value of the

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* *See* Question 3142

Appendix XV.

land (x not greater than 25) the value of all timber which was actually ripe for felling at the time when the property passed, and so the practice remained for some time, when a case occurred in which the agricultural property, exclusive of timber, approximated to twenty-five years' purchase in value, and in addition there was standing in the wood (which had been well forested) a large quantity of timber of all ages, from ten years to three hundred, besides a considerable amount of underwood and coppice.

The accounting parties argued that the suggested value was an infringement of the rule as to the "superior limit," and supported their views by the opinions of two counsel of eminence.

The Commissioners, after advice taken, then adopted the following practice, which is that now in use.

If there is no such expectation of increased income as to enhance the price obtainable, then ascertain the net annual property tax value, as defined in the proviso, of all the agricultural property comprised in the estate, and multiply it by twenty-five. The value must not exceed this, but, of course, it may fall below it if the property, including the timber, is not worth so much for sale.

The Commissioners have some time since instructed their surveyors of taxes that in assessing woodlands for property tax the yearly value was to be taken to be the rent which the lands in their natural state might reasonably bring in as pasture or grazing land.

The following examples which occurred in recent practice are annexed.

(A) An extract from a timber account for succession duty. The successor (being a life tenant) was chargeable in respect of timber under Section 23 of the Succession Duty Act.

(B) Extract from an estate duty account where the value of the timber was excluded (though considerable) because the agricultural property was already brought into the account at the maximum value.

(C) Extract from an estate duty account where part of the value of timber was brought in so as to make up the value of the agricultural property to the maximum; the balance of the value of timber being excluded.

A. *Extract from a Succession Account of Timber felled and sold.*

Form No. 10.

INLAND REVENUE.

[For Payment of Duty on Money arising from Sales of Timber.]

☞ Here state the Name and Address of the Person who forwards the Account. ______________________

This Form of Account is for the Payment of Duty on Moneys arising from the Sale of Timber upon Property comprised in a Succession.

16 & 17 Vict c. 51, sec. 23.

It is provided by the Succession Duty Act, 1853 (16 & 17 Vict. c. 51), s. 23, that :—"Where timber, trees, "or wood, not being coppice or underwood, shall be comprised in any Succession, the successor shall "be chargeable with Duty upon his interest in the net moneys, after deducting all necessary outgoings "for the year, which shall, from time to time, be received from any sales of such timber, trees, or "wood, and shall account for and pay the sums yearly: Provided that no Duty shall be payable on "the net moneys received from the sale of timber, trees, or wood in any one year unless such net "moneys shall exceed the sum of ten pounds: Provided, that if the successor shall be desirous of "commuting the Duty, and shall deliver to the Commissioners an estimate of the net moneys "obtainable by him from the sale of such timber trees, and wood, as may, in a prudent course of "management of the property, be felled by such successor during his life, the Commissioners, if "satisfied with such estimate, shall accept the same and assess the Duty accordingly."

This provision does not apply where the Succession Duty is payable in the first instance upon the principal value of the property under the Finance Act, 1894 (57 & 58 Vict. c. 30), s. 18 (1).

Timber must be sold separately from the property.

Duty is also chargeable under this section in respect of timber sold, and does not attach to growing trees sold with the property.

Repairs.

The duty does not attach to timber used for repairs; but if the timber be sold, and the proceeds be expended in the purchase of other timber or in improving the property, the duty attaches.

Bark liable.

If the bark be stripped from the trees and sold, the sale moneys will be chargeable with duty.

Trees must have been growing when succession opened.

The duty does not extend to the sale moneys of timber from trees which were not growing upon the property at the time when the successor became beneficially entitled to the property in possession.

Wood yielding yearly profit.

Coppice and other wood capable of yielding a yearly profit should be included in the general account of the succession.

Necessary outgoings.

The necessary outgoings are those which are intrinsically necessary, and do not include any expenses incurred by the successor for his mere convenience, or for purposes of ornamentation.

What they include.

They include the expenses of the sale, the expenses of felling and drawing out the timber, and of restoring fences, ditches, roads, and gates, injured by the felling and drawing out of such timber, in so far as these expenses are borne by the vendor; also the expenses of the year in which the sale takes place in connection with the growth of the timber actually sold.

Commutation as to future sales.

Successors desirous of commuting the duty presumptively payable in respect of future sales should apply, in writing, to the Controller of Legacy and Succession Duties, and forward an estimate by a competent person showing the amounts which, in a prudent course of management of the property, are likely to be obtained during the successor's life.

☞ OBSERVE.—1. The Account when filled up in duplicate should be transmitted to the Secretary, Estate Duty Office, Somerset House, London, W.C.

2. Money should not be remitted until this account has been delivered by the parties, and the amount payable and the mode of payment have been notified to them.

REGISTER , of the Year 1 Folio .

TITLE.

(1.) Please read the instructions printed on previous page.

(2.) Insert name of successor.

(3.) Insert full postal address.

(4.) Here state the Title, whether under Will, Settlement, Intestacy, or by Descent, and if under any Deed or other Document the date thereof, and the names of the parties thereto. If under a Will, state date and place of Probate, or if under an Intestacy, state date of Grant of Administration, and where issued.

(5.) Here state name and addresses of accounting parties, and in what capacity they act.

An Account (¹) of the succession to moneys arising from the sale of timber, trees and wood

of (²) *A. D. S.*

of (³)

upon the death of *A. P. B. D. S.*

who died on the *2nd* day of *October 1894*

derived from *E. A. D. S.*

the predecessor, under (⁴) *his Will*

delivered by (⁵) *the successor*

of

Date of Sale.	Gross Amount realised.	Nature of Deductions.	Amount of Deductions.	Net Amount realised.
	£. s. d.	*Wiltshire and Somerset Estate:*	£. s. d.	£. s. d.
1895 - - - - - - -	103 15 –	*Expenses of sale by auction, cutting and dragging, measuring, valuing and lotting* -	26 2 –	77 13 –
1896 - - - - - - -	612 – –		134 15 –	477 5 –
1897 - - - - - - -	1,927 – –		334 18 –	1,592 2 –
1898 - - - - - - -	1,755 – –		355 1 –	1,399 19 –
1899 - - - - - - -	1,337 10 –		273 8 –	1,064 2 –
	5,735 5 –		1,124 4 –	4,611 1 –
		Devonshire Estate:		
1895 - - - - - - -	34 8 –	*Expenses of sale, cutting, dragging, measuring, planting, &c., and work in woods* - -	156 19 3	412 16 8
1896 - - - - -	670 11 3		135 3 4	
1897 - - - - - - -	290 18 8		117 11 11	173 6 9
1898 - - - - - - -	217 16 3		94 10 –	123 6 3
1899 - - - - - - -	126 – 10		94 – 11	31 19 11
	1,339 15 –		598 5 5	741 9 7
If the space be insufficient a schedule may be annexed.			Total - - - £.	5,352 10 7

DECLARATION :—

I (or) We declare that this is a just and true Account of all the moneys received since the *2nd* day of *October 1894*, from the Sale of Timber, Trees, and Wood, not being coppice or underwood, on the property to which *A. D. S.* was entitled to succeed beneficially upon the Death of the before named

and that the said *A. D. S.* is a (₁) *descendant of a brother of* *E. A. D. S.* the Predecessor from whom the said Property is derived.

(1) State the consanguinity in the words of the Act. (See back of Form.)

Dated this *16th* day of *February 1901*.

(Here sign the Account.) *C. W. and W. for the Successor.*

Appendix XV.

For Official use only.]

ASSESSMENT.

The Succession Duty on the within sum of - - - - - - - - - - -	£ 5,352 10 7
at the rate of *3* per cent. is assessed at - - - - - - - - - - -	160 11 6
Interest thereon - - - - - - -	12 8 10
	£ 173 - 4

Somerset House,
London, W.C.

By the Commissioners

Examiner.

22nd February 1901.

RECEIPT FOR DUTY.

Received the day of 190

the sum of

being the Amount mentioned in the above Assessment.

£ " "

Registered,

pro Accountant. *pro* Cashier.

For Acct. and Compt. Genl. of Inland Revenue.

RATES OF DUTY.

	Where the Deceased died before the 1st July 1888, or where Estate Duty under the Finance Act, 1894, has been paid upon the property.	Where the deceased died on or after the 1st July 1888, and Estate Duty under the Finance Act, 1894, has not been paid upon the property.
* **Lineal Issue or Lineal Ancestor of the Predecessor** - - -	1 per cent.	1½ per cent.
Brothers and Sisters of the Predecessor and their Descendants -	3 do.	4½ do.
Brothers and Sisters of the Father or Mother of the Predecessor and their Descendants.	5 do.	6½ do.
Brothers and Sisters of a Grandfather or Grandmother of the Predecessor and their Descendants.	6 do.	7½ do.
Persons of more remote consanguinity or Strangers in Blood -	10 do.	11½ do.

* Persons otherwise chargeable with Duty at the rate of 1 per cent. are exempt in respect of any property which passes under the Deceased's will or intestacy or under his disposition or any devolution from him, or under any other disposition under which respectively Estate Duty under the Finance Act, 1894, has been paid.

The Husband or Wife of the Predecessor is not chargeable with Duty, and a Successor, whose Husband or Wife is of nearer relationship to the Predecessor, is chargeable with Duty at the rate at which such Husband or Wife would be chargeable. The relations of the Husband or Wife of the Predecessor are chargeable with Duty at 10 per cent., or at 11½ per cent., as the case may be, unless themselves related in blood to the Predecessor.

☞ OBSERVE.

1. The Duty is payable yearly in respect of the net proceeds of sale of timber received in the year, provided such net sale moneys exceed 10*l*.
2. Interest at the rate of 3 per cent. per annum is chargeable upon all Succession Duty in arrear, under the provisions of the Finance Act, 1896 (59 & 60 Vict. c. 28), s. 18 (2).
3. The liability to account for and pay the Duty in no way depends upon application being made by the Commissioners.

Appendix XV.

B.—*Extract from an Estate Duty Account. The entire Agricultural Estate, including the Woodlands, was bought in at 25 years' purchase, so nothing additional was claimed for Timber.*

[For use where the Deceased died at any time AFTER the 1st August, 1894.]

INLAND REVENUE.

ESTATE DUTY.
Finance Acts, 1894 to 1900.

[This form is for property chargeable with Estate Duty on an "Account." *See* Finance Act, 1894, sect. 6 (4). A separate form (C—2) is provided for "Settlement Estate duty" on settled property. See sect. 5 (1) (*a*).]

FORM C—1.

[This form should be filled up in duplicate, and be transmitted to the Secretary, Estate Duty Office, Somerset House, London, W.C.; only one copy need be sworn.]

Full Instructions as to Estate Duty will be found in the form A—2.

Official Reference—

Regr. ______ 1____ Fo.______ Affidt.______

☞ Here state the name and full address of the person who forwards this account ______

An "ACCOUNT" of property chargeable with ESTATE DUTY on the death of ______ *A. B.* ______

late of ______ who died on the ______

day of ______ *1898*, and to whom Represention was granted at ______

on the ______ day of ______ 1____.

TITLE.

Date and short material particulars of disposition, with date of and names of parties to any deed, and name of any testator and date of probate of his will.	Names and addresses of present trustees.	Names and addresses of *living* beneficiaries. If any of the persons originally entitled are dead, give dates of death and of representation.	Consanguinity to the deceased.	Consanguinity to the Predecessor (naming him) under whose disposition the property is derived.
Under Settlement and Re-settlement.				

* * * * * * *

Appendix XV.

Part III.—REAL PROPERTY [not including (i.) Leaseholds for years or (ii.) Real Property subject to a trust for conversion in the Deceased's lifetime.]

Insert in this column consecutive numbers opposite each item of property	Description of property, including situation, tenure, quantity, (tenants' names, and nature of tenancy, and distinguishing between arable meadow, pasture orchards, gardens, woods, moors, commons, wastes, pleasure grounds, building land, &c.	Rental, if let, or gross (not rateable) value for the poor rate, if unlet and not assessed to Property Tax	Gross value for property tax (not the reduced assessment for collection under Finance Act, 1894 s. 35).	Nature of deductions from gross annual value. [Tenants' outgoings should not be deducted unless payable by landlord.]	Amount of annual deductions.	Net Annual value	No. of years purchase as estimated	Estimated principal value as at the date of the Deceased's death, and gross amount realised, if since sold
	Agricultural property .	£. s. d.	£. s. d.		£. s. d.	£. s. d.		£. s. d.
1.	*Various items*	1,988 17 1	1,981 5 -	*Repairs, insurance, management*	261 15 10	1,719 9 2	25	42,986 9 2
2.	*225 a. 1 r. 24 p., woodlands, plantations, and timber (in hand)*	—	71 - -	*Repairs and management 5 per cent.*	3 11 -	67 9 -	25	1,686 5 -

OBSERVE.—As to agricultural property, see Finance Act, 1894, ss. 7 (5) and 22 (1) (g).
If the real property include unlet fishing or sporting rights, church patronage, timber, unlet building land, mines or other property which has no annual value or the annual value whereof is no criterion of the principal value, full details should be given.
Generally, as to all property, all such particulars should be furnished as are requisite to arrive at the principal value.
Should the space be insufficient, the account and schedule should be continued upon separate sheets.

GROSS TOTAL . £ 44,672 14 2

NOTE.—Item 2 was originally valued upon the basis of the value of the timber, viz., at 11,295l., but as the whole of the purely agricultural land was valued at 25 years' purchase this valuation was reduced to the value of the land on basis of gross property tax assessment. Thus loss in value = 9,608l. 15s., and duty reduced by 624l.

Schedule of Debts and Incumbrances on the above Real Property.

Items of property numbered as in the above Account.	Nature of debt or incumbrance and by whom created.	Short material particulars of security, with date of and names of parties to any deed, and name of any testator and date of probate of his will.	Names and addresses of persons to or in whom the debt or incumbrance is now due or vested.	Amount of the debt or incumbrance.
				£. s. d.
—				
			TOTAL DEDUCTIONS . . . £.	
			NET TOTAL . . . . £.	

OBSERVE.—Terminable charges should be capitalised.

C.—*Extract from an Estate Duty Account.—The surface of the agricultural property was bought in at 23 years' purchase. Part of the value of the timber was added so as to bring the total value up to 25 years' purchase and the balance of the value of timber was struck off.*

[For use where the Deceased died at any time AFTER the 1st August 1894.]

INLAND REVENUE.

ESTATE DUTY,
Finance Acts, 1894 to 1900.

[This form is for property chargeable with Estate Duty on an "Account." *See* Finance Act, 1894, sect. 6 (4). A separate form (C—2) is provided for "Settlement Estate duty" on settled property. *See* sect. 5 (1) (*a*).]

FORM C—1.

[This form should be filled up in duplicate, and be transmitted to the Secretary, Estate Duty Office, Somerset House, London, W.C. Only one copy need be sworn.]

Full instructions as to Estate duty will be found in the form A—2.

Official Reference—

Regr .... 1______. Fo.______ Affidt.______________

☞ Here state the name and full address of the person who forwards this account - ______________________

Appendix XV.

AN "ACCOUNT" of property chargeable with ESTATE DUTY on the death of *J. H.*
late of
who died on the ______ day of ______ *1898*, and to whom Representation was
granted at ______ on the ______ day of ______ 1 ______.

TITLE.

Date and short material particulars of disposition, (with date of and names of parties to any deed, and name of any testator and date of probate of his will.	Names and addresses of present trustees.	Names and addresses of *living* beneficiaries. If any of the persons originally entitled are dead, give dates of death and of representation.	Consanguinity to the deceased.	Consanguinity to the Predecessor (naming him) under whose disposition the property is derived.
By Settlement dated 25 June 1863.				

* * * * * * *

Part III.—REAL PROPERTY [not including (i.) Leaseholds for Years or (ii.) Real Property subject to a trust for conversion in the Deceased's lifetime.]

Insert in this column consecutive numbers opposite each item of property.	Description of property, including situation, tenure, quantity, tenants' names, and nature of tenancy, and distinguishing between arable, meadow, pasture, orchards, gardens, woods, moors, commons, wastes, pleasure grounds, building land, &c.	Rental, if let, or gross (not rateable) value for the poor rate, if not let and not assessed to Property Tax.	Gross value for property tax (or the reduced assessment for collection, under Finance Act, 1894, s. 35).	Nature of deductions from gross annual value [Tenant's outgoings should not be deducted unless payable by landlord.]	Amount of annual deductions.	Net annual value.	No. of years' purchase as estimated.	Estimated principal value as at the date of the Deceased's death, and gross amount realised, if since sold.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.		£ s. d.
1	Surface land	6,396 — —	—	—	1,175 8 9	5,220 11 3	23	120,072 18 9
2	*Amount brought in in respect of timber on before-mentioned properties sufficient to bring the total principal value of the agricultural property up to 25 years of net rental.*	—	—	—	—	—	—	10,441 2 6*

OBSERVE.—As to agricultural property, see Finance Act, 1894, ss. 7 (5) and 22 (1) (g).
If the real property include unlet fishing or sporting rights, church patronage, timber, unlet building land, mines or other property which has no annual value, or the annual value whereof is no criterion of the principal value, full details should be given.
Generally as to all property, all such particulars should be furnished as are requisite to arrive at the principal value.
Should the space be insufficient, the account and schedule should be continued upon separate sheets.

GROSS TOTAL - - £. 135,514 1 3

* *NOTE.—This valuation was originally 21,584l.*

Schedule of Debts and Incumbrances on the above Real Property.

Items of property numbered as in the above Account.	Nature of debt or incumbrance and by whom created.	Short material particulars of security, with date of and names of parties to any deed, and name of any testator and date of probate of his will.	Names and addresses of persons to or in whom the debt or incumbrance is now due or vested.	Amount of the debt or incumbrance.
				£ s. d.
			TOTAL DEDUCTIONS - - - £.	
			NET TOTAL - - - - - - £.	

OBSERVE.—Terminable charges should be capitalised.

Appendix XVI.

APPENDIX No. XVI. (Q. 3553).

HANDED IN by Professor H. MARSHALL WARD.

OUTLINE SKETCH OF FORESTRY COURSE.

Part I.

Botany,
Chemistry,
Mechanics and Physics,
Geology.

Here the students would pass through the general course, and aim at obtaining a thorough grounding in the principles of these branches of science. They would attend the same lectures and laboratory courses as do the agricultural students, but attention should be directed in their schedule to those parts which have a special bearing on forestry. I would suggest, *e.g.*,

Botany.—The elements of the morphology, histology and anatomy, and the physiology of the flowering plants.

The phenomena of germination, and the changes which occur in sprouting buds, tubers, etc. The organography of roots, stems, leaves, &c. The relations of roots to soil, the phenomena of absorption, and the nature of the salts absorbed by roots. The structure of wood, and the phenomena of the ascent of water in trees. The description of leaves, their anatomy, and the functions of transpiration, respiration, assimilation of carbon, &c. The nature of cell-walls and cell contents, liquefaction, the formation and utilisation of starch, sugar, oil, &c. The living cell contents, cell division, and the structure and functions of cambium: growth in thickness and in length. The importance of light, temperature, and other factors of the physical environment. The structure and functions of flowers, with especial reference to those of forest trees and the phenomena of reproduction, hybridisation, grafting, budding, pruning, etc.

The elements of classification as illustrated by European forest trees, shrubs, and herbs. More detailed study of the Natural Orders — Coniferæ, Salicaceæ, Betulaceæ, Fagaceæ, Corylaceæ, Juglandaceæ, Ulmaceæ, Tiliaceæ, Aceraceæ, Celastraceæ, Rosaceæ, Leguminosæ, Platanaceæ, Myrtaceæ, Rubiaceæ, Caprifoliaceæ, Gramineæ.

The principal groups of Cryptogamic plants, with special reference to fungi.

In chemistry, mechanics and physics and geology, I should suggest that the students attend the same courses as the agricultural students, their attention being directed in the schedules to certain special points bearing on forestry.

Others would doubtless be willing to aid in drawing up the special schedules.

It will be noted that the whole course of instruction here sketched is already given at Cambridge, and is in full working order so far as agricultural students are concerned.

I would urge that especial attention be given to experimental physics and mechanics, and to chemistry and physical geology.

Part II.

Special Forest Botany and Natural History.

Forest Botany.—Special study of the structure and properties of the various kinds of wood. The identification of wood, and of species of trees by their leaves, buds, &c. The diseases of timber and of forest plants generally, with especial reference to the following:

Disease.—The connection between normal and abnormal physiology. Cause and investigation of disease.

Injuries due to higher parasites. Mistletoe, Loranthus, Cuscuta, Orobanche, other phanerogamous parasites, Epiphytes, weeds.

Epiphytic and Saprophytic fungi. Parasitic fungi. The chief diseases due to fungi. Killing of seedlings by Pythium, Phytophthora, and the destruction of beech and other seedlings. Disease caused by Ustilagineæ Uredineæ, and the damage they do to conifers and other trees. Wound parasites, Hymenomycetes, and the destruction of timber. Dry rot, Erysipheæ, and mildews on leaves, Pyrenomycetes, and the destruction of seedlings by Rosellinia. Other diseases due to Pyrenomycetes, Parasitic discomycetes, Peziza, and the larch-disease. Other parasitic diseases.

Wounds.—Healing by cork, occlusion, excretions of resin, turpentine, &c. Burrs and adventitious buds, &c.

Diseased conditions caused by abnormal states in soil, &c. Their explanation and treatment dependent on knowledge of physiology. Dying off of twigs. Stagnation of air and water in soil. The rotting of roots. Poisons, action of frost. Intense insolation. Smoke and acid gases in air. Lightning. Other injurious factors.

Perhaps special courses in the biology of soil, bacteriology, &c., would be desirable in addition.

Forest Zoology (including Entomology).

A more special knowledge of the habits and life history of various birds and other animals of importance in woodlands, either as enemies to trees or to insects, and in particular the study of entomology from the point of view of the forester.

Part III.

Forestry. Sylviculture.

Forest soils and certain peculiar relations of trees to soil and climate. The formation of woods. Planting. Pure and mixed forests, sylvicultural systems. Natural and artificial regeneration. The tending of growing woods. Thinning and pruning. Felling.

Forest management; normal and abnormal forests; how forests degenerate, and how to convert abnormal forest into normal forest. Reserves. Arrangement of cuttings. The division, survey and mapping of forests. Selection of special system and rotation. Measurement. Determination of age, increment, volume, etc. Yield tables and regulation of yield. Working plans.

Forest Utilisation.—Felling and preparation, disposal and transport of timber. Accessory forest products, bark, fibres, resin, dyes, etc. Technical properties and treatment of timber for industrial purposes. Sawing. Charcoal, etc.

Forest Protection.—Measures to be taken against damage by man and other animals, especially insects; and against injury by weeds, parasites, and especially fungi. Precautions as regards extremes of climate, snow, flooding, etc. Forest legislation and administration.

As regards the more special courses of instruction in surveying, accounts, forest engineering, etc., I should think there could be little difficulty in arranging for the adaptation of courses already given to agricultural students to the slightly different needs of forestry, though in my opinion these technical subjects are best given at a special school.

Appendix XVII.

APPENDIX No. XVII. (Q. 3643).

HANDED in by Mr. JOSEPH PARRY, M. Inst. C.E.

STATEMENT showing the NUMBER of TREES planted on CORPORATION LANDS around LAKE VYRNWY, 1896–1902.

Species.	Number.	Species.	Number.
Larch	25,430	Weymouth Pine	6,000
Scots Fir	42,600	Beech	15,250
Douglas Fir	13,380	Sycamore	4,400
Spruce Fir	15,500	Ash	10,000
Corsican Pine	28,400	Alder	1,300
		TOTAL	162,260

Appendix XVIII.

APPENDIX No. XVIII. (Q. 3734).

HANDED IN by MR. MARTIN ROBERTS.

Oak.

The Postmaster-General for a number of years past has taken all possible steps to obtain sufficient supplies of native-grown oak for telegraph construction purposes. These steps have consisted in largely advertising in the timber trade and local newspapers, and obtaining from Post Office engineers in the provinces, the names and addresses of likely English timber merchants, and inviting them to tender. He has, however, found it impossible to obtain native oak at reasonable prices in sufficient quantities to fully meet the Post Office requirements, and consequently experiments have from time to time been made by the Post Office Department to determine the relative merits of foreign-grown oak and other descriptions of timber, and in connection with these experiments figures have been obtained which enable me to put in comparative tables showing the strength of native as compared with foreign-grown oak.

Oak. Method of testing.

In telegraph construction oak is mainly employed for the cross arms on telegraph poles; when so used it is subjected to two strains, *i.e.*, cantilever and torsion. I am putting in drawings showing the method adopted for testing oak telegraph arms. The Post Office has now practically only one length of arm in use, namely 48 inches, and the tests have in all cases been made with arms of this length, with a cross section of 2½ inches by 2½ inches. In the case of the cantilever tests the arm is secured in the centre by a bolt ⅝in. in diameter and a washer. One end of the arm presses against a solid block of iron to give a suitable bearing, and the other end is tested by a direct transverse strain. For the torsional test the centre attachment and the support at the disengaged end are similar to those I have just described, and the torsional strain is applied to the equivalent of an ordinary telegraph insulator, the deflection and the weight required to cause fracture being recorded. In the diagram the strain is shown as applied at the groove of the insulator 4 inches above the upper plane of the arm, but in practice the insulator is dispensed with, and an attachment is used to give the same leverage.

Oak. Results of tests.

Tables 1 and 2 give the results of cantilever tests of native and foreign oak respectively. The average for native timber comes out the higher, but this is largely due to the very low results given by some specimens of Hungarian oak, and I should not be prepared to say that for cantilever tests well selected foreign oak would give appreciably lower results than average English oak. In the case of the torsional tests, however, the figures are almost invariably very much in favour of native timber. Recent tests are recorded in Tables 3 and 4, and from the results obtained it will be seen that if we represent the strength of native oak as 100 when subjected to torsion, the average strength of foreign oak would be represented by 79·7.

The results given in Tables 1, 2, 3, and 4 are fairly representative of my experience extending over a number of years with the exception, perhaps, that the figures given for Irish and Scotch oak are somewhat above the average, due to recent deliveries of this timber being of high quality, whereas recent deliveries of English oak appear to be rather below the average.

It is noteworthy that South Russian oak, which gives an excellent average when subjected to a cantilever test, comes out no better than other Continental oak when subjected to the torsional test, and it is perhaps right that I should say that although Scotch oak gives such excellent figures in both tests, the Post Office has experienced the greatest possible difficulty in obtaining Scotch oak for arms. I understand this is due to Scotch timber as a rule being small, and consequently the waste in cutting the arms free from sapwood, and the heartshake makes the business unremunerative.

I am unable to express any definite opinion as to the reason why native oak as a rule stands such a much greater torsional or twisting strain than oak grown on the Continent, but I have reason to think it is owing to English oak being, as a rule, grown in open situations instead of its being close together in woods. This opinion is based on the fact that I have from time to time met with very straight grown and clean English oak, which timber merchants have described to me as "coppice grown," and I have generally found that such oak will not give the torsional results obtained from specimens of rougher growth.

Oak. Effect of seasoning.

In Tables 1, 2, 3, and 4 the weight is given of each arm tested. The considerable variation in weight is largely due to seasoning, and I do not attach very great importance to these figures, but it is interesting to observe the very high results obtained with the Scotch samples, although in the average they are lighter than any other specimen of native timber. These figures show that the strength of oak is not reduced by seasoning within moderate limits.

As many English timber merchants are without machinery to manufacture arms, to increase the sources of supply the Postmaster-General accepts oak in the form of scantling and converts this oak into arms at one of the telegraph factories. The Post Office specification for oak scantling is put in (see p. 195).

I have from time to time made tests of various descriptions of timber other than oak for use for telegraph arms, and at the present time an Australian wood, named "Karri," is largely used, but this timber is not as suitable as English oak if the latter could be obtained in sufficient quantities to meet the Post Office requirements.

Scotch fir, use of, for telegraph poles.

During the autumn of 1892, Mr. John Campbell, a timber merchant in Inverness, issued a printed circular letter asking the recipient to urge the Postmaster-General to adopt Scotch fir for telegraph poles instead of foreign timber. The circular letter was as follows:—

"Sir, "20th October, 1892.

"I beg to draw your attention to the Government contracts for telegraph poles. They are advertising for tenders at present for the supply of Norway red fir poles, and the time expires for receiving these tenders on Friday the 21st.

Appendix XVIII.

"I would take it as a great favour if you would use your influence in trying to get the Postmaster-General to go in for our native Scotch fir. It is well known that this class of wood is much superior to the foreign, where durability is concerned, and it can also be got quite straight for all practical purposes.

"I think you will agree with me in saying that the Government ought to do their utmost to foster the native industry where the timber can be acquired at about the same rates as the foreign.

"It is important that some pressure should be used at once on the Postal Telegraph Department, otherwise they will close with some foreigners for next year's supply, consequently this market will be closed to us in the native timber trade for another year.

"We were never more in need of a stimulant to the native industry than at present, as prices have not been so bad for the last forty years as they are at this moment, and are likely to be during the ensuing winter and spring unless the Government can be induced to try our native fir for telegraph poles, which would help us to tide over this depression in our trade.

"I am,
"Your obedient servant,
"John Campbell,
Wood Merchant."

Mr. Campbell also on the same date submitted a tender to the Post Office for the shorter lengths of poles required for the Telegraph Department during the following year. Mr. Campbell's prices, as a whole, were considerably in excess of the tender which was ultimately accepted for Norwegian poles, but apart from the question of price, and the question of the suitability of the timber, it would have been impossible for the Postmaster-General to place an order with Mr. Campbell for the shorter lengths of poles only, as the Postmaster-General would then have been unable to obtain the longer poles required, as foreign timber merchants decline to quote for long poles only, owing to the difficulty which is experienced in obtaining suitable long timber, and also owing to the expense of shipping long poles without shorter poles to fill up broken stowage; consequently, quotations can only be obtained for long poles when short poles also are ordered.

Efforts made by the Postmaster General to obtain Scotch timber for telegraph poles.

The Postmaster-General, however, invited Mr. Campbell and certain other timber merchants to tender for 50 poles as samples to the following specifications for sizes, and a trial order was placed during January, 1893:—

Specification for Scotch Fir Poles.

Number.	Description.	Length.	Diameter at top under bark.		Minimum Diameter at 5 feet from butt.
			Minimum.	Maximum.	
		Feet.	Inches.	Inches.	Inches.
20	Poles, light - - - -	28	5	6	7
20	" medium - -	30	6	7¼	8¾
10	" stout - - -	30	7½	9½	10¾

Thirty-three poles out of the 50 ordered were supplied during the following spring, and the report of the officer deputed to examine them was as follows:—

> "I attach a detailed statement as regards length and sizes of Scotch fir poles lying in Aberdeen pole yard. This is the first opportunity I have had of examining each pole separately, and I was so badly pleased with them that I took careful measurements, and made minute examination of each pole, and I think only the first nine enumerated are fit for our work.
>
> "The three linemen here could do nothing with them alone owing to the great weight of the poles, and I had to get other two men to assist in moving them. The barking and dressing of these poles is also a tedious and expensive process owing to the innumerable knots in the Scotch fir.
>
> "22nd April, 1893."

Statement referred to in Inspector's Report.

Length.		Diameter at top in inches.	Diameter at butt in inches.	Diameter five feet from butt in inches.	Remarks.
Feet	Ins.	Inches.	Inches.	Inches.	
28	3	6	12	9·6	Good pole.
28	3	6½	11	9·9	Good, but knotty.
28	5	6	11½	9·	- - ditto.
28	6	7	11½	10·2	- - ditto - and heavy.
28	6	6	10½	9·6	- - ditto.
29	0	5¾	10	8·3	Good stick.
30	3	6	11½	9·	Fairly good.
30	3	6	11	9.6	Good, but many knots.
30	6	6¾	11¾	9·2	- ditto - ditto and heavy.
26	7	7	10	9·9	Ugly stick and heavy.
28	0	5½	10½	9·2	Some bad bends at top end.
28	2	6	11	9·9	Badly bent at upper end.
28	5	5½	10¾	8·	Bent at centre.
28	5	6	12	10·2	Bent badly and heavy.
28	5	6	10	9·6	Crooked throughout, and especially at top.
28	5	6½	11	9·2	Bent at centre.
28	6	6¼	11	9·2	Big bend 4 feet from top.
28	7	6	12	10·2	Bent at middle.
29	0	6	14	10·5	Heavy stick and twisted.
30	3	7	12	10·9	Ditto, and bad bend at centre.
30	3	8	13	11·5	Ditto, three bends, innumerable knots.
30	2	7	12½	10·8	Ditto, and twisted.
30	4		12	11·5	Stout all along and bent.

STATEMENT referred to in Inspector's Report—*continued*.

Length.		Diameter at top in inches.	Diameter at butt in inches.	Diameter five feet from butt in inches.	Remarks.
Ft.	Ins.	Inches.	Inches.	Inches.	
30	5	7½	12	10·8	Bent at upper end.
30	5	6½	13	9·2	Twisted.
30	5	9	13½	12·4	Tremendous weight.
30	6	7	13	11·14	Bent badly.
30	6	7	12	10·5	Crooked and heavy.
30	10	9	14	12·	All knots, bent, and heavier than our 50 feet poles.
30	11	7	13	11·5	Heavy stick, bent and knotty.
31	0	8½	15	12·4	Very heavy; could never be lifted to "set."
31	0	7	11½	10·8	Stout throughout, bent, ugly.
31	1	7½	14	11·5	Very heavy, ugly, and very knotty.

22 April 1893.

It is understood that the poles were supplied from Aberdeenshire.

As it was thought the contractors had perhaps not fully understood the requirements, a further order was placed for 75 poles, with the understanding that the poles for this order should be obtained from other districts, and it was ultimately arranged, on the contractors' suggestion, that one truck load should come from Perthshire, one from Deeside, Aberdeenshire, and one from Ross-shire. This order was never executed in full, but 57 poles were ultimately accepted. The most suitable parcel was received from Novar, in Ross-shire, and the inspector's report on these 25 poles is given in the following statement:—

Length in feet.		Diameter at butt in inches.	Diameter 5 feet from butt in inches.	Diameter at top in inches.	Remarks.
Ft.	ins.	Inches.	Inches.	Inches.	
28	4	10	8	5½	Very nice pole.
28	4	9½	8¼	5½	Good straight pole.
28	5	9	8	6	- ditto.
28	5	10¾	8	6	Very good pole.
28	5	12	9¼	6½	- ditto.
28	5	12	8½	7	- ditto.
28	6	11	9½	6¼	Fair.
28	6	11	9¾	6	Good light pole.
28	6	11¼	9¼	7	Good.
28	7	12	10¼	7	Good, straight, but heavy.
30	4	14	11¼	7½	Ugly stick and heavy.
30	4	14¾	10¼	8¼	Good, but heavy.
30	6	12½	11	7¼	- ditto.
30	6	12	10¼	7¼	- ditto.
30	6	11¼	10¼	7¼	ditto.
30	6	12	10¼	7¼	- ditto.
30	7	11	9¾	6¼	- ditto.
30	7	15	10¼	8	Very ugly stick, and heavy
30	8	12	10½	8¾	- ditto - and badly dressed.
30	8	12½	11½	7½	Good, but stout and rough.
30	8	13	9½	6¾	Good.
30	8	12	8¾	6½	Very pretty stick.
30	8	12	10¼	6½	Good.
30	9	12	10½	8	Heavy pole and not a beauty.
30	10	14	10¾	8½	- ditto - but good.

A further order was subsequently placed for 20 22ft. light, 20 26ft. light, and 10 30ft. medium poles. This order was never satisfactorily executed. During the latter part of 1893 further invitations to tender for 50 sample poles were issued to eight firms. One timber merchant only tendered, and, on an order being placed, the poles were supplied from Forfarshire. These poles were described as a fairly good lot in appearance, but the timber generally was less straight than Norwegian fir, and it contained many large and rough knots.

During 1897 a further trial order was placed for 100 Scotch fir poles. In this case the poles were supplied from Deeside, Aberdeenshire, and the quality of the timber was practically the same as the parcel from Ross-shire in 1893.

elative erits of or-egian nd cotch fir.

During the year 1895 a number of experiments had been made by the Post Office to determine the strength of Norway red fir telegraph poles, and it was thought desirable to make tests of certain representative Scotch fir poles supplied under the trial orders referred to above to determine the strength of Scotch fir telegraph poles as compared with Scandinavian. The results of the tests made of the Norwegian poles are given in Tables 5 and 9, and of the Scotch fir poles in Tables 6, 7, 8, and 10.

The testing apparatus used to determine the strength of the various specimens was specially constructed for the purpose. It is shown in the accompanying drawing. A stout wrought iron cylinder, six feet long, was secured on a suitable framing. About 5ft. 6in. of the butt end of the pole to be tested was placed inside this cylinder, and carefully packed all round and tightly rammed with gravel. The cylinder was then secured horizontally, and a scale pan suspended from what would be the resultant point of a line of telegraph wires, an oak plank being used as a saddle to distribute the load. The weights furnished in the tables in Column W comprise the weight of the scale pan and saddle, the added weights, and the calculated weight, applied at Q., of the unsupported length of the pole.

Table 5 gives the result of tests made with creosoted Norwegian poles, and tables 6, 7, and 8 the result of tests made with creosoted Scotch fir poles.

Appendix XVIII.

Summarised, the result of the tests of creosoted Norwegian, as compared with creosoted Scotch fir poles, is as follows:—

Table.	Description.	Average of K.	Relative Strength, *i.e.*, Relative Value of K.
5	Norwegian, creosoted -	1,337·12	100
6	Scotch fir, creosoted, 1894 - -	1,182·67	88·44
7	- - ditto - - 1895 - - -	953·54	71·31
8	- - ditto - - 1897 - - -	1,223·68	91·51

It is perhaps somewhat unfortunate, so far as the inquiry of this Committee is concerned, that most of the tests were made with poles which had been creosoted, but the tests of the Norwegian timber were originally undertaken to determine the strength of creosoted poles for telegraph purposes, and as the general comparison is made with creosoted timber, the figures probably fairly represent the relative value of Scotch and Scandinavian fir for telegraph purposes.

I have, however, the results of three tests made of uncreosoted Norwegian timber and three of uncreosoted Scotch fir. These figures are respectively given in Tables 9 and 10, and it will be seen that they are in close agreement with the comparative results obtained from creosoted timber:—

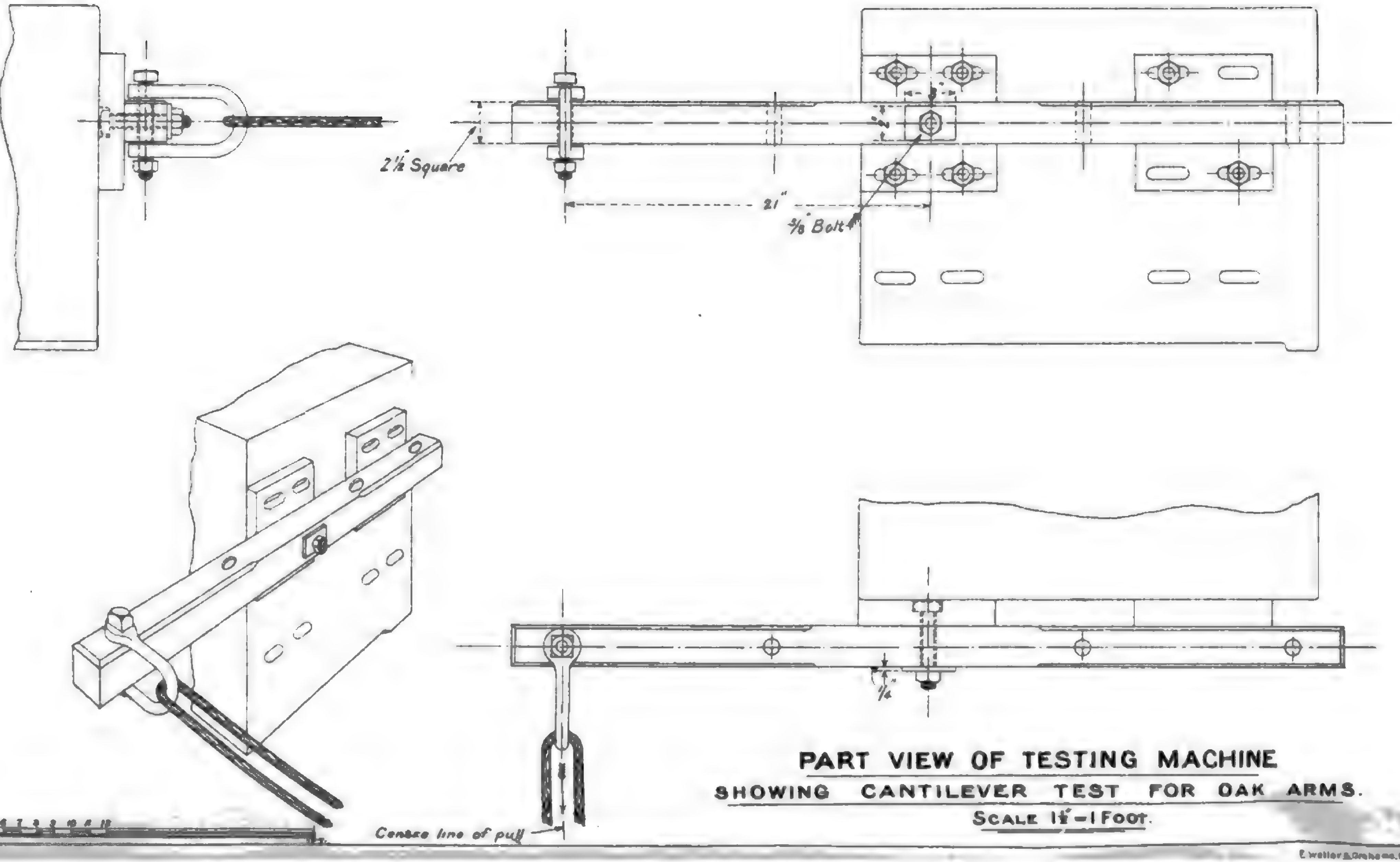
Table.	Description.	Average of K.	Relative Strength, *i.e.*, Relative Value of K.
9	Norwegian, uncreosoted -	1,231·62	100
10	Scotch fir uncreosoted - -	998·15	81·04

I am unable to say why Scotch fir compares so unfavourably with Norwegian fir. The explanation which has been given to me by Scotch timber merchants is that Scotch fir is grown much quicker than Norwegian, and on richer soil. It should, however, be remembered that in the Postmaster-General's specification for Norway timber, a copy of which I put in (*not printed*), hard grown poles with a small amount of sapwood are specified for, and, before orders are placed, suitable precautions are taken to ensure that poles in compliance with the specification will be supplied, and, further, the poles are subjected to rigid inspection before acceptance. It would consequently not be correct to assume that the comparison made in the case of telegraph poles supplied to the Postmaster-General fairly represents the value of Scotch as compared with Norwegian timber used for other purposes. For example, the bulk of the Norwegian mining timber imported, so far as my experience goes, would compare unfavourably with well-grown Scotch fir.

Apart, however, from the question of the strength of the timber, it does not appear probable that long, straight Scotch fir poles, i.e., poles from 40 to 75 feet in length, are obtainable, and from the poles supplied under the trial orders it would appear that even with the shorter lengths much difficulty would be experienced in getting shapely poles.

Larch poles.

Larch poles are used only to a very limited extent for telegraph construction purposes, as it is not possible to inject creosote oil into larch.


2½" Square
21"
⅝" Bolt
¼"
Centre line of pull
INS 1 2 3 4 5 6 7 8 9 10 11 12

PART VIEW OF TESTING MACHINE

SHOWING CANTILEVER TEST FOR OAK ARMS.

SCALE 1½"–1 FOOT.

E. Weller & Graham, Ld Litho London

TABLE I.

CANTILEVER TESTS OF OAK ARMS.

Native (English, Scotch, Irish)

$$K = \frac{WL}{BD^2}.$$

W = Load in lbs. at collapse.

L = Leverage in inches (21″ in all cases).

B and D = Breadth and depth of section in inches (2½″ in all cases).

County in which Timber was grown.	Weight of Arm.		Set (in 64ths of an inch) with load of (lbs.).										W.	K.
			224		448		672		896		1,120			
	lbs.	oz.	Temporary.	Permanent.	Temporary.	Permanent.	Temporary.	Permanent.	Temporary.	Permanent.	Temporary.	Permanent.		
Cumberland	11	0	18	Nil.	36	Nil.	68	4	98	8	164	24	1,375	
Gloucestershire	10	9	14	,,	32	,,	44	Nil.	66	Nil.	-	-	1,120	
Ditto	9	13	18	,,	38	,,	56	2	94	6	-	-	1,041	
Worcestershire	9	12	20	,,	40	2	58	4	110	6	190	20	1,176	
Ditto	9	1	20	,,	40	Nil.	68	2	104	8	-	-	1,064	
Surrey	9	5	16	,,	30	,,	50	2	78	4	116	10	1,200	
Hants	9	10	16	,,	40	,,	56	2	86	6	154	18	1,131	
Averages (English)	9	14	17·4	Nil.	36·5	0·3	57·1	2·3	90·9	5·4	-	-	1,158	1,556
Stirlingshire	—		12	Nil.	24	Nil.	40	2	60	4	100	8	1,344	
Perthshire	8	4	12	,,	28	,,	46	2	68	3	90	4	1,536	
Ditto	8	12	16	,,	30	,,	48	3	66	4	94	6	1,355	
Averages (Scotch)	8	8	13·3	Nil.	27·3	Nil.	44·7	2·3	64·7	3·7	94·7	6	1,412	1,898
Louth	11	9	14	Nil.	34	2	46	4	68	6	92	8	1,445	
Ditto	10	15	12	,,	20	Nil.	32	Nil.	46	2	66	6	1,321	
Ditto	10	6	10	,,	18	,,	24	,,	38	2	68	6	1,345	
Averages (Irish)	10	15	12·0	Nil.	24·0	0·7	34·0	1·3	50·7	3·3	75·3	6·7	1,370	1,841
GRAND AVERAGE (British)	9	15	15·2	Nil.	31·5	0·3	48·9	2	75·5	4·5	-	-	1,266	1,701

REMARKS.—In all cases the arms were, as far as possible, bored in such a direction that the insulator-bolt hole was at right angles to the medullary rays.

The temporary sets were measured after the loads had been supported for one minute, and the permanent sets one minute after the loads had been removed.

Appendix XVIII.

TABLE II.

CANTILEVER TESTS OF OAK ARMS.

FOREIGN.

$$K = \frac{WL}{BD^2}$$

W = Load in lbs. at collapse.

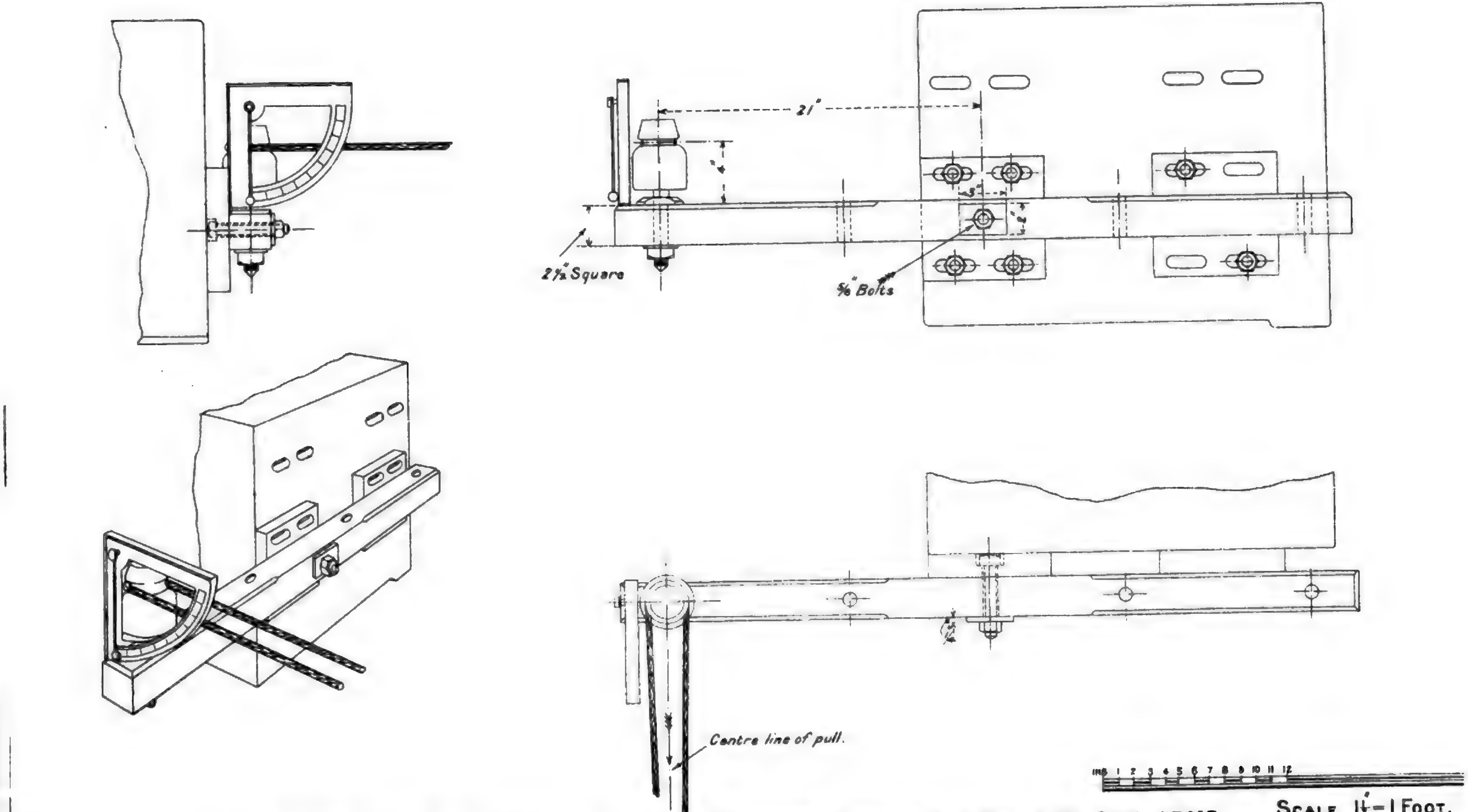
L = Leverage in inches (21 inches in all cases).

B and D = breadth and depth of section in inches (2½ inches in all cases).

DISTRICT.	Weight of Arm.		Set (in 64ths of an inch) with load of (lbs.).										W.	K.
			224		448		672		896		1,120			
			Temporary.	Permanent.	Temporary.	Permanent.	Temporary.	Permanent.	Temporary.	Permanent.	Temporary.	Permanent.		
	lb.	oz.												
South Russia	11	4	8	nil	16	1	32	2	44	4	64	6	1,714	—
Ditto	7	13	12	,,	28	2	48	8	72	16	—	—	1,129	—
Ditto	10	5	28	,,	36	nil	48	4	80	8	120	12	1,254	—
Ditto	10	0	6	,,	12	,,	40	2	56	4	96	16	1,926	—
Ditto	8	0	16	,,	32	,,	50	2	70	4	—	—	1,084	—
Ditto	8	1	16	,,	38	2	62	4	92	6	—	—	1,120	—
Ditto	9	8	14	,,	34	nil	58	2	92	4	—	—	1,120	—
Averages	9	4	14·3	nil	28	0·7	48·3	3·4	72·3	6·6	—	—	1,335	1,794
Stettin	8	8	26	nil	56	2	95	5	140	22	—	—	985	—
Ditto	8	12	24	,,	40	2	78	6	—	—	—	—	896	—
Ditto	7	14	24	,,	44	nil	68	2	—	—	—	—	896	—
Ditto	8	4	20	,,	40	2	70	6	96	8	—	—	1,120	—
Ditto	8	3	24	,,	38	nil	56	2	78	6	120	12	1,120	—
Averages	8	5	23·6	nil	43·6	1·1	73·4	4·2	104·6	12	—	—	1,055	1,418
Hungary	9	15	16	nil	40	4	64	6	108	10	—	—	963	—
Ditto	7	12	18	,,	46	2	76	6	114	8	—	—	902	—
Averages	8	13	17	nil	43	3	70	6	111	9	—	—	932	1,253
West Virginia	7	13	8	nil	30	nil	56	2	90	4	—	—	952	—
Ditto	9	4	10	,,	28	,,	50	2	66	4	92	6	1,366	—
American Red	8	7	10	,,	30	,,	48	2	72	4	116	8	1,261	—
American Oak	7	2	16	,,	32	,,	64	2	118	12	—	—	1,036	—
American (Source unknown.)	8	0	12	,,	30	,,	52	1	86	2	—	—	1,120	—
Averages	8	2	11·2	nil	30	nil	54	1·8	86·4	5·2	—	—	1,147	1,542
Grand Average (Foreign)	8	11	16·1	nil	34·2	0·8	58·6	3·4	86·7	6·8	—	—	1,169	1,571

REMARKS.—In all cases the arms were, as far as possible, bored in such a direction that the insulator-bolt hole was at right angles to the medullary rays.

The temporary sets were measured after the loads had been supported for one minute, and the permanent sets one minute after the loads had been removed.


21"
4"
3"
3"
2½" Square
⅝" Bolts
¼"
Centre line of pull.
INS 1 2 3 4 5 6 7 8 9 10 11 12

PART VIEW OF TESTING MACHINE SHOWING TORSION TEST FOR OAK ARMS.

SCALE 1½"=1 FOOT.

E. Weller & Graham's Ld Litho. L

TABLE III.

OAK: COMBINED TORSIONAL AND SPLITTING TEST.

NATIVE.

COUNTY IN WHICH TIMBER WAS GROWN.	Weight of Arm.	Set (in Degrees) with Load of (Lbs.)												Load at which Arm fractured.
		112.		224.		336.		448.		560.		672.		
		Temporary.	Permanent.	Temporary.	Permanent.	Temporary.	Permanent.	Temporary.	Permanent.	Temporary.	Permanent.	Temporary.	Permanent.	
	Lbs. oz.													*Lbs.*
Cumberland	11 4	1	Nil	2¼	Nil	4	1½	5½	2	7	3	9	4	986
Gloucestershire	11 6	1¾	"	3½	"	4½	Nil	5½	Nil	7½	Nil	—	—	672
Ditto	10 8	1¼	"	2¾	"	4½	"	6	"	8½	¼	10½	½	733
Worcestershire	9 8	½	"	3	"	4½	"	6	"	8½	Nil	11	½	880
Ditto	9 7	1½	"	3	"	5	"	7	"	10	¼	13	1¼	889
Surrey	9 10	1½	"	3	"	3½	"	5½	"	7½	Nil	8½	½	772
Hants	11 10	2	"	3½	"	5	"	6	¼	7	½	9½	½	907
Averages (English)	10 8	1·4	Nil	3	Nil	4·4	·2	5·9	·3	8	·6	10·1	1	834
Stirlingshire	—	½	Nil	1¾	Nil	3	½	4½	¾	5½	¾	7	1	1,086
Perthshire	7 13	1	"	1½	"	3	Nil	4	Nil	5½	Nil	7	Nil	974
Ditto	8 9	1¾	"	3½	"	5	"	6½	"	8	½	11	1	956
Averages (Scottish)	8 3	1	Nil	2·2	Nil	3·6	·1	5	·25	6·3	·4	8·3	·6	1,005
Louth	11 12	1½	Nil	3	½	4½	1	6	1½	8½	2¼	10	3	1,576
Ditto	11 3	1½	" ½	3½	½	5¼	1	8	1½	10½	2	13	3½	863
Ditto	9 2	1½	"	3½	Nil	4½	Nil	6	¼	7	½	8½	1	927
Ditto	9 11	1	"	2	"	3	"	4½	Nil	5½	Nil	7	Nil	1,299
Averages (Irish)	10 7	1·3	Nil	3	·25	4·3	·5	6·1	·8	7·8	1	9·6	1·8	1,166
GRAND AVERAGE (British)	10 2	1·3	Nil	2·8	Nil	4·2	·2	5·7	·4	7·6	·9	9·6	1·2	966

REMARKS.—In all cases the arms were, as far as possible, bored in such a direction that the insulator bolt-hole was at right angles to the medullary rays.
The temporary sets were measured after the loads had been supported for one minute, and the permanent sets one minute after the loads had been removed.

TABLE IV.

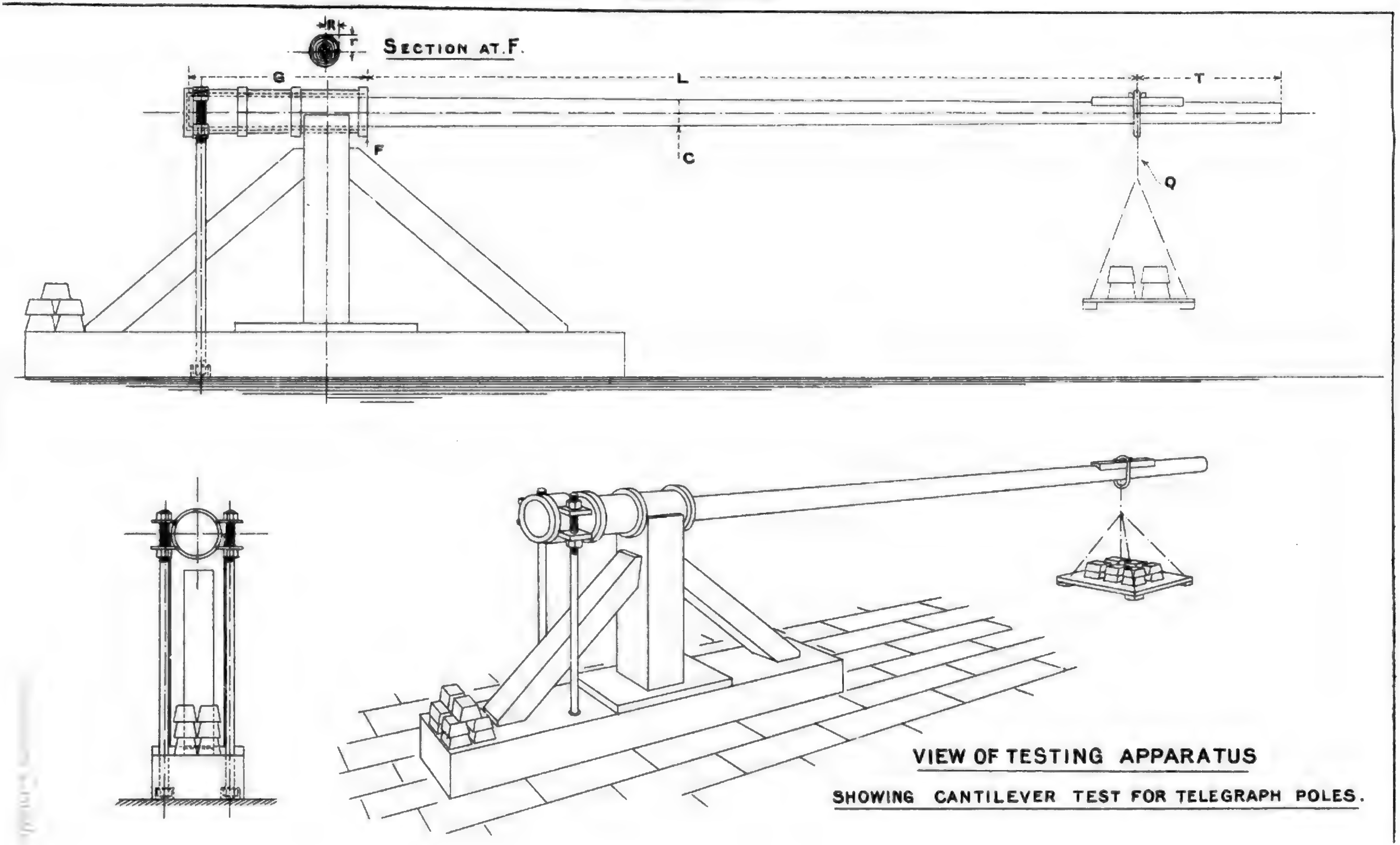
OAK : COMBINED TORSIONAL AND SPLITTING TEST.

FOREIGN.

DISTRICT.	Weight of Arm.		Set (in Degrees) with Load of (Lbs.)												Load at which Arm fractured.
			112.		224.		336.		448.		560.		672.		
			Temporary.	Permanent.	Temporary.	Permanent.	Temporary.	Permanent.	Temporary.	Permanent.	Temporary.	Permanent.	Temporary.	Permanent.	
	Lbs.	ozs.													Lbs.
South Russia	8	5	1	Nil	3	Nil	4	Nil	6	½	8½	1	—	—	604
Ditto	8	12	2	,,	3¼	,,	5	,,	7	½	9½	1	—	—	681
Ditto	10	4	½	,,	2	,,	3½	¼	6	½	8½	1	—	—	616
Ditto	10	12	½	,,	2½	,,	4	¼	5½	½	6½	½	10	1¼	862
Ditto	8	11	1½	,,	2	,,	3½	Nil	4¾	¼	6	½	7	¾	994
Ditto	8	12	1½	,,	3	,,	5	,,	6¾	¼	10	1	16½	3	728
Ditto	7	10	1¼	,,	2½	,,	4	,,	5¾	¼	7	½	10½	1	806
Averages	9	0	1·1	Nil	2·6	Nil	4·1	·1	5·9	·4	8	·7	—	—	756
Stettin	9	0	1½	Nil	3	Nil	5	Nil	6½	½	9	1	13	1¾	728
Ditto	8	8	1½	,,	3½	,,	5½	,,	7½	¼	14	1¾	—	—	649
Ditto	8	8	1¾	,,	3¾	,,	5	,,	7	½	9	½	10½	1	873
Ditto	7	15	1¾	,,	3½	,,	5	,,	6½	Nil	9½	1	11½	1½	761
Ditto	7	13	1½	,,	3	,,	4½	,,	6	¼	7½	½	9½	1	873
Ditto	7	7	2	,,	3½	,,	6	,,	8	¼	10	¾	13½	1½	683
Ditto	7	6	2	,,	3½	,,	5	,,	7½	½	9½	1	11½	1¼	784
Averages	8	1	1·7	Nil	3·4	Nil	5·1	Nil	7	·3	9·7	·9	11·5	1·3	764
Hungary	9	2	1	Nil	2½	¼	4¼	1	6	2	—	—	—	—	649
Ditto	8	0	1	,,	2½	Nil	3½	½	5	1	—	—	—	—	802
Averages	8	9	1	Nil	2½	·1	3·8	·75	5·5	1·5	—	—	—	—	725
West Virginia	9	2	1	Nil	2	Nil	6	½	6	½	8	1	12½	2	784
Ditto	7	0	1	,,	2½	,,	6	Nil	6	Nil	—	—	—	—	593
American Red Oak (Source unknown)	8	11	¾	,,	1½	,,	3	,,	4	,,	5½	¼	6½	½	1,180
Ditto - ditto (Source unknown)	8	2	1½	,,	2¼	,,	4	,,	6	,,	7½	Nil	10	½	705
Ditto - ditto (Source unknown)	8	8	1½	,,	3	,,	4½	,,	5½	,,	7	¼	8½	½	806
Averages	8	5	1·1	Nil	2·2	Nil	4·7	·1	5·5	·1	7	·3	9·3	·8	813
GRAND AVERAGES (FOREIGN)	8	7	1·3	Nil	2·7	Nil	4·5	·1	6·1	·4	8·4	·7	—	—	770

REMARKS.—In all cases the arms were, as far as possible, bored in such direction that the insulator bolt hole was at right angles to the medullary rays.
The temporary sets were measured after the loads had been supported for one minute, and the permanent sets one minute after the loads had been removed.

DIAGRAM III.


SECTION AT F.
R
r
G
L
T
F
C
Q

VIEW OF TESTING APPARATUS

SHOWING CANTILEVER TEST FOR TELEGRAPH POLES.

POST OFFICE TELEGRAPHS.

OAK SCANTLING.

Specification referred to in the accompanying form of tender, No.

(1) The scantling shall be sawn from good strong English or Irish oak of large size.

The person tendering shall here name the district, or districts, in which the oak he will supply has been grown...*

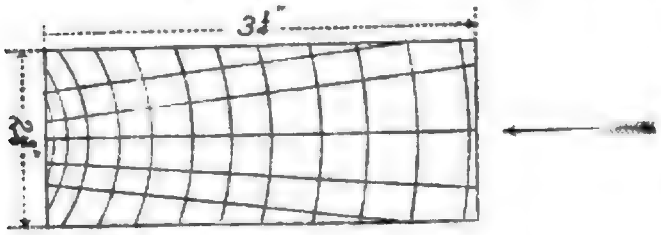
(2) The timber shall be winter-felled, unless otherwise agreed.

The person tendering shall here state when the timber he will supply was, or will be, felled ....*

(3) The timber shall be planked and open-stacked, for seasoning, at least three months before being sawn into scantling.

(4) The scantling shall be cut with the grain of the timber running parallel with the length, and shall be of sound timbers, free from dead wood, sap-wood, the centre pith of the tree, sun-shakes, seasoning shakes, and from such knots as would impair its strength. It shall not be bent or warped.

In the case of scantling 3¼in. by 2¾in. section, it is preferred that it should be cut with the medullary rays running through the timber parallel with the sides of greatest width, *vide* sketch:—



(5) Samples of the oak tendered for, showing the character of the scantling as regards the quality of the wood and its freedom from defects, will be required before an order is issued; and, if approved, these samples will be taken as the standard, for comparison with the supply.

(6) The scantling shall be of one of the sizes shown in the schedule attached to the form of tender, and shall not leave the saw more than 1-16in. under those sizes. Scantling more than 1-16in. under the specified size will be rejected, or will be accepted as, and at the price quoted for, the next smaller size, if any smaller size be due under the order.

(7) On no account shall the ends of scantling be painted. The person tendering shall stamp (not paint) the end of each piece of scantling either with the initials of his firm, or with some other identifying mark.

He shall here state what are the initials, or other identifying mark, to be so stamped.. ....*

Signature of person tendering ....

Date .. .. 190....

General Post Office, London,
January, 1901.

N.B.—Persons who have not previously tendered for oak scantling are informed that, on application to the Superintendent of the Postal Telegraph Factory, Mount Pleasant, London, E.C., they will be shown the scantling in stock, that they may thereby acquaint themselves with the standard of quality required by the Department.

TABLE V

TESTS OF TEN CREOSOTED NORWEGIAN TELEGRAPH POLES, JANUARY 1885.

For method of testing, *see* Diagram III.

M = Cubic Contents: feet.
C = Distance of centre of gravity from F.
W = Weight in lbs.

$$K = \frac{W.L}{4{\cdot}7\,(R^2 x r)}$$

Pole.			G.	L.	T.	Section at F.		M.	C.	W.	K.	Average K.	Remarks.
Length.	Class.	Weight per cubic foot.				R.	r.			Breaking Weight.			
Ft. ins.		Lbs.	Inches.	Inches.	Inches.	Inches.	Inches.	Cubic ft.	Inches.	Lbs.			
26 3	Stout	41·9	60	214	41	4·1	3·9	6·02	110	1,853	1,286·94	1,337·12	Creosoted 1881. Very hard grown.
26 2	"	37·3	60·5	212	41·5	4·2	4·15	6·31	109	2,137	1,316·72		Creosoted 1881. Medium grown.
26 4	"	49·0	67	239	41	4·6	4·55	7·09	116	2,502	1,321·48		Creosoted 1882. Medium sapwood large, fracture flaky.
30 0½	"	51·0	60	252	41	4·45	4·4	7·97	122·5	2,146	1,320·56		Creosoted 1884. Very hard grown.
34 5	"	44·1	66	306	41	5·0	4·75	11·13	136·5	2,309	1,265·94		Creosoted 1882. Medium hard grown
24 1	Light	50·7	54·5	193	41·5	3·35	3·45	4·09	96	1,571	1,483·74		Creosoted 1884. Medium hard grown.
26 0	"	49·7	60	200	41	3·7	3·6	4·8	108	1,628	1,468·91		Creosoted 1883. Medium hard grown.
28 1	"	47·3	60·5	235	41·5	3·95	3·75	5·46	110·5	1,521	1,299·79		Creosoted 1882. Very hard grown.
29 10½	Stout	45·2	64·5	252	41·5	4·05	3·95	7·69	142	1,438	1,190·02		Creosoted 1884. Very hard grown.
8	"	39·5	66	298	40	4·5	4·2	8·78	143	1,901	1,417·18		Creosoted 1870 or 1873. Very hard grown, fracture flaky.

Appendix XVIII.

TABLE VI.

For formula for K, *see* Table V.

TESTS OF EIGHT CREOSOTED SCOTCH FIR POLES, JUNE 1894.

Pole.						G.	L.	T.	Section at F.		C.	W.	K.	Average K.	Remarks.
Length.		Class.	Weight.						R.	r.		Breaking Weight.			
Ft	ins.		Cwts.	qrs.	lbs.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Lbs.			
30	2	Medium	5	1	9½	60	261	41	4·67	4·38	132·5	2,167	1,259·77	1,182·67	Perthshire pole. Fracture four feet from F.
25	2	Light	2	2	20	60	213	41	3·25	3·12	110·6	1,069	1,470·07		Perthshire pole. Fracture near F.
30	8	Medium	6	0	4½	60	267	41	5·38	4·96	136·6	2,999	1,186·70		Ross-shire pole. Fracture twenty inches from F.
30	6	„	5	0	6	60	265	41	4·50	4·31	136·7	1,563	1,009·72		Banffshire pole.
30	6	„	5	1	20	60	265	41	4·68	4·56	135·4	2,135	1,205·28		Ross-shire pole. Fracture two and a half feet from F.
22	3	Light	2	1	6	52·5	173	41·5	3·50	3·37	98·9	1,334	1,189·42		Perthshire pole. Fracture close to F.
30	1	Medium	4	0	8	60	260	41	4·00	4·00	141·6	1,255	1,084·77		Banffshire pole. Fracture six inches from F.
28	6½	„	3	2	18	60	241·5	41	4·43	4·06	124·7	1,637	1,055·68		Ross-shire pole. Fracture twenty inches from F.

Appendix XVIII.

TABLE VII.

For formula for K., *see* Table V.

TESTS OF THREE CREOSOTED SCOTCH FIR POLES, MARCH 1895.

Pole.			G.	L.	T.	Section at F.		C.	W.	K.	Average K.	REMARKS
Length.	Class.	Weight.				R.	r.		Breaking Weight.			
Ft. ins.		Lbs.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Lbs.			
30 4½	Medium	544	60	263·5	41	4·75	4·75	133·3	1,901	994·45	953·54	Fracture close to F.
30 2¼	Stout	694	60	251·5	41	5·25	4·99	135·7	2,630	1063·92		Fracture 21 inches from F.
30 1½	Medium	455	60	260·5	41	4·875	4·75	136	1,634	802·26		Fracture close to F.

These poles all came from Forfarshire.

TABLE VIII.

For formula for K., *see* Table V.

TESTS OF FIVE CREOSOTED SCOTCH FIR POLES, APRIL 1897.

Pole.			G.	L.	T.	Section at F.		C.	W.	K.	Average K.	REMARKS.
Length.	Class.	Weight.				R.	r.		Breaking Weight.			
Ft. ins.		Cwt. qrs. lbs.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Lbs.			
30 6¾	Light	4 0 27	60	255·75	41	4·125	3·75	124·11	1,541	1314·13		Fracture 2 feet from F.
30 7½	Medium	4 2 11	60	266	41·5	4·25	4·125	137·97	1,411	1071·78		Fracture 1 foot from F.
30 6¾	„	5 2 0	60	265·25	41·5	4·81	4·37	137·92	1,862	1039·35	1223·68	Fracture at F.
30 5	Light	3 3 6	60	264	41	3·87	3·75	139·34	1,329	1329·16		Fracture 3 feet from F.
30 5¼	Medium	6 1 10	60	263·75	41·5	4·75	4·75	136·29	2,605	1364·02		Fracture 1 foot from F.

Appendix XVIII.

TABLE IX.

For formula for K., *see* Table V.

TESTS OF THREE UNCREOSOTED NORWEGIAN FIR POLES, MAY 1885.

Pole.			G	L.	T.	Section at F.		M.	C.	W.	K.	Average K.	REMARKS.
Length.	Class.	Weight.				R.	r.			Breaking Weight.			
Ft. In.		Lbs.	Inches.	Inches.	Inches.	Inches.	Inches.	Cubic feet.	Inches.	Lbs.			
29 7	Stout -	35·27	66·5	247	41·5	4·8	4·6	8·08	113	2,217	1,099·31		Sound, hard wood. Fracture 31½ inches from F.
30 0	ditto -	34·06	66	252·5	41·5	4·5	4·25	7·72	122	2,022	1,262·20	1,231·62	Fracture 2 feet from F.
29 10½	ditto -	39·97	66	251	41·5	4·3	4·25	7·58	124	1,962	1,333·36		Fracture 6 feet from F.

Appendix XVIII.

TABLE X.

For formula for K., *see* Table V.

TESTS OF THREE UNCREOSOTED SCOTCH FIR POLES, 1894 TO 1895.

Pole.			G	L.	T.	Section at F.		C.	W.	K.	Average K.	REMARKS.
Length.	Class.	Weight.				R.	r.		Breaking Weight.			
Ft. Ins.		Lbs.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Lbs.			
28 2	Medium	426	60	237	41	4·06	3·75	125	1,501	1224·46		Banffshire pole. Fracture through centre.
30 1½	ditto -	437	60	260·5	4	4·75	4·625	138·8	1,930	1025·10	998·15	Fracture 18 inches from F. Forfarshire pole.
30 4½	ditto -	390	60	263·5	41	4·75	4·50	137	1,349	744·89		Forfarshire pole. Fracture six inches from F.

Appendix XIX.

APPENDIX, No. XIX.

MEMORANDUM PREPARED BY THE LOCAL GOVERNMENT BOARD.

Statement of the statutory provisions dealing with the rating to the Poor Rate and other Local Rates of Woodlands in England and Wales.

(1) *The Poor Rate.*

Rating of saleable underwoods.

The authority for the levy of the poor rate is derived from Section 1 of the Poor Relief Act, 1601 (43 Eliz., c. 2). That statute authorised the taxation by the overseers of every inhabitant, parson, vicar, and other, and of every occupier of lands, houses, tithes impropriate or propriations of tithes, coal mines, or saleable underwoods, in the parish for which the rate was made.

The statute of Elizabeth authorised the rating of the underwood itself, and it appears to have been considered that land upon which saleable underwood grew was not assessable to the poor rate. The express mention of saleable underwoods in the statute was also held to imply that wood not within this term was exempt from the poor rate. Thus in "Rex v. Inhabitants of Minchinhampton" (1762), 3 Burr, 1309-12, it was held that beech being timber according to the custom of the place in which the question arose was not rateable, and in "Rex v. Inhabitants of Ferrybridge" (1823), 1 B. and C., 375 firs and larches planted with oaks for the purpose of sheltering the latter, and cut as the oaks grew larger, were considered to be similarly exempt.

Rating of plantations, woods, &c.

But by Section 14 of the Rating Act, 1874 (37 and 38 Vict., c. 54), so much of the statute of Elizabeth as related to the taxation of an occupier of saleable underwoods was repealed, and by Section 3 of the Act, the statute of Elizabeth, and the Acts amending the same, were extended to land used for a plantation or a wood or for the growth of saleable underwood, and not subject to any right of common.

Under this enactment it is the land, and not the timber, underwood, or other produce of the land, which is made the subject of assessment, and it would seem that if land used as a plantation or a wood or for the growth of saleable underwood is subject to common rights, it is exempt from the poor rate and other local rates.

Mode of valuing woodlands.

The method of estimating the gross estimated rental and rateable value of such woodlands is prescribed by Section 4 of the Act, and is as follows:—

> "(a) If the land is used only for a plantation or a "wood, the value shall be estimated as if the land "instead of being a plantation or a wood were let "and occupied in its natural and unimproved state.
>
> "(b) If the land is used for the growth of sale-"able underwood, the value shall be estimated as if "the land were let for that purpose.
>
> "(c) If the land is used both for a plantation or "a wood and for the growth of saleable underwood, "the value shall be estimated either as if the land "were used only for a plantation or a wood, or as "if the land were used only for the growth of the "saleable underwood growing thereon as the assess-"ment committee" (or where there is no assessment committee the persons making the poor rate) "may "determine."

A copy of a circular letter which the Board on the 24th November, 1874, addressed to assessment committees in England and Wales, drawing their attention to the principles which would govern the assessment of the various kinds of property made subject to local rates by the Rating Act, 1874, is appended.

Since the date of this circular two decisions have been given by the Queen's Bench Division of the High Court upon the construction of Section 4 of the Act of 1874. In the case of the "Earl of Westmorland v. Southwick and Oundle," (1877), 36 L.T. n.s. 108; 41 J.P. 231, it was decided that in ascertaining the rateable value of a plantation or wood as "land let and occupied in its natural and unimproved state," it was not admissible to base the estimate upon the rent which a hypothetical tenant would give after expenditure had been laid out in grubbing up woods, in draining and fencing and in making roads. In the case of "Eyton v. Mold Churchwardens and Overseers" (1880), L.R. 6 Q.B.D. 13, 50 L.J.M.C., 39; 43 L.T. 472, it was held that the value of a right of sporting over land might properly be included in estimating the rateable value of a plantation or wood as land in its natural and unimproved state.

Deduction of rate from rent.

Where the rateable value of woodlands was increased by reason of the same being estimated in accordance with Section 4 of the Act of 1874, an occupier under any lease or agreement made before the commencement of the Act (for this purpose, the 6th April, 1875), was empowered to deduct from his rent during the continuance of the lease or agreement any additional sum paid as rates in respect of such increase of rateable value (37 and 38 Vict., c. 54, section 5).

Poor rate payable in full.

Woodlands are not agricultural land within the meaning of the Agricultural Rates Act, 1896, and an occupier of woodlands is liable to pay the full amount in the pound of any poor rate assessed upon him in respect of such property.

(2) *Other Local Rates.*

General district rate, separate rate for special sanitary expenses, lighting rate.

By Section 10 of the Rating Act, 1874, any hereditament made rateable to the poor rate under that Act became subject to all other local rates leviable upon property rateable to the relief of the poor. Woodlands are thus rateable to a general district rate made by a town council or urban district council under Section 210 of the Public Health Act, 1875 (38 and 39 Vict., c. 55), or to any separate rate for special sanitary expenses levied by overseers in a rural parish under Section 230 of the same Act, or to any lighting rate levied in a rural parish under the Lighting and Watching Act, 1833 (3 and 4 Will. IV., c. 90).

In the case of the general district rate an occupier of woodlands is to be assessed on one-fourth part of the rateable value (38 and 39 Vict., c. 55, section 211 (1) (b)). Similarly an occupier of woodlands is to be assessed to a separate rate for special sanitary expenses, where a special assessment is made for the rate, on one-fourth part of the rateable value, or if no special assessment is made, he pays one-fourth part only of the rate in the pound payable in respect of houses and other property (38 and 39 Vict., c. 55, s. 230).

As regards a lighting rate levied under Section 33 of the Lighting and Watching Act, 1833, it is open to question whether an occupier of woodlands is liable to pay one-third only of the rate in the pound payable by an occupier of houses, buildings, and property other than land (3 and 4 Will. IV., c. 90, s. 33; 37 and 38 Vict., c. 54, ss. 3, 10; Reg. v. Somerset Justices [1858] 22 J.P. 431, 31 L.T. o.s. 215).

The doubt as to the position created by the 37 and 38 Vict., c. 54, in this instance originates in the decision of the House of Lords in the case of "Thursby and Another v. The Churchwardens and Overseers of the Parish of Briercliffe with Entwistle" (L.R. 1895 A.C. 32).

Upon the reasoning adopted in that case, it would seem to be arguable that the occupiers would be rateable on the higher scale. But it is possible that a further judicial decision may be needed to settle the doubt.

Public library rate.

Where the Public Libraries Act, 1892, is in force in a rural parish the rate levied to meet the expenses of the library authority is raised by the overseers with and as part of the poor rate, but a person assessed in respect of woodlands to the public library rate is entitled to an allowance of two-thirds of the sum assessed upon him (55 and 56 Vict., c. 53, s. 18).

Separate county rate, school board rate, &c.

The expenses of county councils, school boards, and the expenses of rural district councils chargeable as general expenses under Section 229 of the Public Health Act, 1875, Section 29 of the Local Government Act, 1894, or any other Act, are usually defrayed out of the poor rate, but where part only of a parish is liable to be assessed to meet any of these expenses, a separate rate may be levied by the overseers over the area liable

A separate borough rate and a watch rate may also be levied in some instances by town councils of boroughs, and separate highway rates are also raised in some boroughs and urban districts.

In the absence of any special provision on the subject in a local Act, an occupier of woodlands would be liable to pay any of the separate rates above referred to, like the poor rate, in full.

Local Government Board,
1902.

Circular Letter to Clerks of Assessment Committees.

THE RATING ACT, 1874.

(37 and 38 Vic., c. 54.)

Local Government Board,
Whitehall, S.W.,
24th November, 1874.

Sir,—I am directed by the Local Government Board to draw the attention of the Assessment Committee to the Rating Act, 1874 (37 and 38 Vict., c. 54), which was passed during the last Session of Parliament, to amend the law respecting the liability and valuation of certain descriptions of property for the purpose of rates.

Although the Act will not come into operation so as to render the property affected by its provisions liable to be actually rated until the 6th day of April, 1875, it will be seen by Section 11 that, for the purpose of enabling any hereditament to be included in a valuation list, which will come into force after that day, the Act takes effect from the date when it passed, viz., the 7th of August, 1874.

In order, therefore, that a proper basis may be provided for the rates to be made during the ensuing parochial year, it is desirable that, in all those cases where new or supplemental valuation lists will be necessary in order to the assessment of any property made rateable by the above-mentioned Act, directions should be forthwith given for the preparation of such lists, in order that their revision may be proceeded with, and that they may be ready for approval as early as practicable after the 6th of April next.

The main object of the Act is to abolish the exemptions from rating which have hitherto existed with respect to the following properties:—

1. Land used for a plantation or a wood.
2. Rights of sporting, when severed from the occupation of the land.
3. Mines other than coal mines.

I.—*As to Plantations and Woods.*

Under the former law (43 Elizabeth, c. 2), saleable underwoods alone, of all descriptions of woods, were rateable; whereas, under the new Act, land used for a plantation or a wood, as well as land used for the growth of saleable underwood, is rendered liable to assessment subject to the exception hereinafter referred to.

It is to be noted that the timber and other trees or shrubs themselves are not made assessable, but the land on which they are growing; and therefore the present statute expressly repeals so much of the 43rd of Elizabeth as relates to the assessment of the occupier of saleable underwood, and imposes the liability in respect of the land on which it is produced.

In dealing therefore, in future with woodland of every kind, the subject in respect of which the assessment is made will be the land itself, and not the underwood, timber, or other trees produced upon it.

The Act classifies this description of property under three heads, viz.:—

1. Land used only as a plantation or a wood.
2. Land used for the growth of saleable underwood.
3. Land used both for a plantation or a wood, and also for the growth of saleable underwood.

1. In the first case, viz., where the land is used only for a plantation or a wood, and not for the growth of saleable underwood, the Act provides that the gross and rateable value (meaning by gross value the gross estimated rental, as defined by the Union Assessment Committee Act, 1862) shall be estimated as if the land, instead of being a plantation or a wood, were let and occupied in its natural and unimproved state.

It will be the duty, therefore, of the Assessment Committee to deal with the land as if it were divested of timber or wood of any description, and to determine its value without taking into account any improvement which has been made, or of which the land might be capable.

It will be observed that the words used are "as if the land, instead of being a plantation or a wood, were let and *occupied* in its natural and unimproved state," and the word "occupied" was introduced in order to show clearly that the capabilities of the land for improvement were to be excluded from consideration in estimating the rent at which it might reasonably be expected to let from year to year, and that the land was to be valued as if it would continue to be occupied in its natural state, without any expenditure of capital in its improvement; or, in other words, as if it were waste land.

It may be useful to state, for the information of the Assessment Committee, that in the Act for the valuation of lands and heritages in Scotland (17 and 18 Vict., c. 91), a somewhat similar enactment is found, as Section 6 of that Act provides that "where lands consist of woods, copse, or underwood, the yearly value of the same shall be taken to be the rent at which such lands might, in their natural state, be reasonably expected to let from year to year as pasture or grazing lands."

2. The second case is that of land used exclusively for the growth of saleable underwood; and the statute requires that in such case the value shall be estimated as if the land were let for that purpose.

It has already been stated that hitherto it has not been the land, but its produce, viz., the saleable underwood, which has been assessable; and although the present Act reverses that rule, and renders the land assessable instead, the mode of arriving at the value will virtually remain the same, as the value of the land can only be arrived at by estimating the value of its produce.

3. With respect to the third case of composite woods, *i.e.*, where the land is used both for a plantation or a wood, and also for the growth of saleable underwood, the value is to be estimated either as if the land were used only for a plantation or a wood, or as if the land were used only for the growth of the saleable underwood growing thereon, as the Assessment Committee may determine.

In this case, therefore, it is entirely within the discretion of the Assessment Committee to adopt either alternative; but it must be borne in mind that if they assess the land as if it were used for the growth of saleable underwood, the land cannot be valued as if it were let for the growth of saleable underwood and capable of improvement for that purpose, but only in respect of the saleable underwood actually growing thereon, irrespective of any capacity for improvement by the removal of trees, or otherwise.

It should be added that woodlands, which are subject to rights of common, are not rendered rateable by the Act.

II.—*As to Rights of Sporting and Fishing.*

The Assessment Committee are aware that under the statute (43 Elizabeth, c. 2) rights of sporting, when severed from the occupation of the land, have not been considered to be assessable. Thus, if the owner let his land, reserving to himself the right of sporting, or let his land to one person and the right of sporting to another, no one according to the general opinion could be rated in respect of such right, although the land itself might be let at a lower rent in consequence of the existence of the right so severed.

Where, however, the occupier of the land, whether as owner or tenant, possessed the right of sporting, and either retained it himself or let it to another person, the Courts held that in estimating the value of the land to the occupier, the value of the right so possessed, or let by him, ought to be taken into account.

In the case of the Queen *v.* the Battle Union, decided in the Court of Queen's Bench in 1866, Chief Justice Cockburn said:—

"The right to take game upon land is an incident to the occupation of the land. If the land is let without any reservation or previous granting of that right, the right follows as a necessary consequence of the right of occupation. If we find that the occupier of the land derives a benefit, whether from taking game himself or from a pecuniary recompense made to him for allowing someone else to take it, it follows, inas-

Appendix XIX.

much as the right to take the game is *ex concessis* merely an element of value, that where the two things are thus united in one person, the right to game must be taken as an element in arriving at the rateable value of the occupation.—L. R. 2, Q. B., 13.

Under the previous law, therefore, although the right itself was in no case separately rated, still, under certain circumstances, it formed an element in estimating the rateable value of the land ; but hereafter the right, whenever severed, will be separately rateable, except where the owner retains both the land and the right, or lets the land and retains the right without letting it.

Where the right is not severed, or where the owner retains both the land and the right, or lets them both to one tenant, the owner or occupier will continue to be rateable upon the same principle as heretofore ; but, in any other case, the right will be dealt with under section 6 of the new Act.

That section provides that where any right of sporting is severed from the occupation of the land and is not let, and the owner of such right receives rent for the land, the right shall not be separately valued or rated, but the gross and rateable value of the land shall be estimated as if the right were not severed.

It will be seen, therefore, that in the particular case referred to, and which, as the Board believe, represents the ordinary arrangement between landlord and tenant, the right, although severed, will not be valued separately ; but, as in the case where the owner retains both the land and the right, the right will simply be considered as an element in arriving at the rateable value of the occupation.

The direction of the statute is that the value of the land shall be estimated *as if the right were not severed.* It would appear, therefore, that in dealing with the right as an element of value, it ought not to be estimated upon any such consideration as that of the rent, which a third person might be found to give for it ; but according to its worth, if any, to the occupier of the land, upon the supposition that the right is not severed ; or, in other words, that he himself is entitled to exercise the right, without the power of making a profit by letting it.

The effect, therefore, of this provision will be to place those lands which are let with a reservation to the owner of the right of sporting, on the same footing in relation to rateability as the lands which he himself occupies, retaining the right to the game upon them.

Thus, if there should be in the same parish, or union, two farms, one being in the occupation of the owner and another in the occupation of a tenant, the landlord in both cases having the right of sporting and not letting it, the proper course would seem to be to apply the same principle of assessment to the two farms, and to assess that in the occupation of the tenant, so far as the right of sporting constitutes an element of value, upon precisely the same basis as that retained by the owner.

It would, however, be manifestly unjust that, if the rateable value of any property happens to be increased by the addition of the value of the right of sporting, the occupier should have to bear the additional rate in respect of such increase ; and, with the view of enabling him to deduct from his rent the additional rate so occasioned, the same section (6) requires the Assessment Committee, on the application of such occupier, to certify in the valuation list, or otherwise, the fact and amount of such increase.

The preceding remarks are mainly directed to those cases where the right of sporting is retained by the owner. Where, however, it is let, it will be rateable as a separate hereditament, and the ordinary rules of law for determining the gross estimated rental and rateable value of other kinds of property will apply.

There may also be some few exceptional cases where the right, although distinct from the ownership of the land, as under a grant of free warren or other special grant or reservation, is of some real and appreciable value, and in these cases also the ordinary principles of assessment will apply.

The foregoing observations relative to the right of sporting are equally applicable to the future assessment of the right of fishing.

* * * *

Miscellaneous Provisions.

The foregoing provisions are those which chiefly affect the duties of the Assessment Committee.

There are others which provide for the deduction of rates under existing contracts, and for the rating of other persons than the occupiers, and to which it will only be necessary to refer very briefly.

Where the rateable value of any woodland is increased by reason of the Act, the occupier under any agreement or lease made before the passing of the Act is enabled to deduct from his rent the additional rate paid by him on any such increase of rateable value, and it will be the duty of the Assessment Committee, on the application of the occupier, to certify the fact and amount of such increase, as in the case where the occupier becomes liable to an increased rate in respect of a right of sporting retained by the owner, and not let.

* * * *

The Act further provides that where a right of sporting is severed from the land and let, either the owner or lessee of the right may, in the discretion of the overseers, be rated for the same.

In like manner the owner of any right of sporting, when severed, although not let, may be rated as the occupier thereof, except as already stated where the owner receives rent for the land over which the right extends.

It is important to observe that in those cases where any person is authorised by the Act to deduct any rate or part of a rate from any rent, royalty, or dues payable by him, the person receiving the rent, royalty, or dues, has the same right of objection and appeal with reference to the valuation list or rate as the occupier.

The Board cannot attempt to do more in a circular letter than point out the principles which will govern the assessment of the several kinds of property now rendered subject to local rates. The application of those principles to individual cases will rest with the Assessment Committee, and the Board entertain no doubt that they will discharge this important and somewhat difficult duty in a careful, considerate, and impartial manner.—I am, Sir, your obedient servant,

JOHN LAMBERT, Secretary.

To the Clerk to the Assessment Committee.

Appendix XX.

APPENDIX, No. XX.

MEMORANDUM BY SIR WILLIAM T. THISELTON-DYER, K.C.M.G., F.R.S., DIRECTOR OF THE ROYAL BOTANIC GARDENS, KEW.

The question divides into two heads : (i.) Forestry in the United Kingdom ; (ii.) in the Empire at large

(i.) As regards the United Kingdom, I regard the problem as a purely economic one. Timber is simply a crop, and it will be grown as soon as it can be shown that there is a reasonable prospect of profit.

Dr. Schlich, in whose opinion I have full confidence, considers that the world's supply of timber will be exhausted before that of coal. Already Europe fails to meet its wants by some 3,000,000 tons. The time is probably not very distant when the New World will cease to be able to supply the deficiency. The value of timber has consequently risen in the five-year period, 1895-9, according to Dr. Schlich, by 18 per cent. That any large area of the United Kingdom will be converted into forest is improbable. I do not think, therefore, that there will be any considerable demand at home for trained forest experts. But I think that with the improved price of timber the amount of small woodlands will increase, and that there will be a considerable demand for skilled woodmen in the future. I have no doubt that there is already room for some system of giving such men a better training than they now possess, perhaps on the lines on which journeymen gardeners are trained at Kew.

Appendix XX.

(ii.) With regard to the Empire at large, the state of things described in my evidence given before the Select Committee in 1885 is rapidly becoming acute. The problem is not one of re-afforestation, but of working on proper principles and preserving from exhaustion forests which already exist. Most of the work connected with it in the Crown Colonies passes through my hands. The only source at present from which trained forest officers can be obtained is the Indian Forest Service. I have recently had to deal with the supply of forest officers to the Straits Settlements, Ceylon, Nigeria, and Trinidad. The system is not wholly regarded with favour by the Government of India, and the incidental difficulties have had in great measure to be overcome by personal influence rather than on strictly official lines. I very much doubt whether it will be possible to strain the resources of the Indian Forest Department much further.

Indian forest officers are trained at the Indian Civil Engineering School at Cooper's Hill. The system has recently been a good deal criticised, and Sir Dietrich Brandis and myself were requested by the Secretary of State for India to report upon it. In this report we recommended that the service should be recruited in a different manner, and that the school should be removed to Cambridge.

I have no doubt that such a school might serve the colonies, including the self-governing ones as well as India.

W. T. Thiselton-Dyer.

Kew, March 24th 1902.

APPENDIX No. XXI.

Appendix XXI.

Handed in by Mr. E. Stafford Howard C.B.

Areas under Wood of Crown Forests in the United Kingdom.

Name of Wood or Forest.	County.	Area in Acres under Wood.
Dean Forest	Gloucester	15,664
High Meadow Woods	"	3,404
Abbotswood Estate	"	524
Tintern Abbey Estate	Monmouth	3,000
New Forest	Hants	23,088*
Alice Holt Woods	"	1,892
Woolmer Forest	"	656
Bere Woods	"	1,420
Parkhurst Woods	"	1,160
Windsor (excluding Great Park)	Berks	10,000
Delamere Woods	Cheshire	2,100
Chopwell Woods	Durham	870
Eltham Woods	Kent	240
Hazelborough and Salcey Woods	Northampton	1,700
Esher Woods	Surrey	840
	Total	66,758

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* Only 16,000 acres of this area can be dealt with as woodland by the Crown.

Appendix XXII

APPENDIX, No. XXII.

REPRESENTATION BY THE UNIVERSITY COURT OF THE UNIVERSITY OF EDINBURGH to the Departmental Committee appointed by the Board of Agriculture to inquire and report as to the present position and future prospects of forestry, &c.

As members of the Committee are aware, forestry has been taught in this University for the past 13 years. But the teaching has been conducted under the grave disadvantage that there are no growing woods within which the lecturer can give practical instruction to his class. And yet such instruction is as essential in sylviculture as in chemistry—the subject cannot be properly taught by means of class-room lectures only. Unfortunately there are no woods within reasonable distance of Edinburgh—indeed, it is doubtful whether any are to be found in Scotland—which have been for a sufficient length of time under scientific management to serve the purpose of practical instruction in economic forestry. Nor is it likely that a model forest of the kind required will ever come into existence on any private estate. Inevitable changes of ownership, following death or sale, and the consequent absence of continuity in management, must act unfavourably on the proper development of forests. It is needless, in short, to expect that the woods on a private estate will be continuously treated in a scientific manner by three or four successive generations of owners. Such being the case, it is much to be desired that Government should make provision for at least one small State forest in Scotland to serve for purposes of practical instruction. Such a forest, being under State control, would not be subject to the unfortunate fluctuations in aim and method which act so detrimentally in the case of the privately-owned woods. While the provision of one or more State forests would be of the greatest advantage from the University's point of view, it would at the same time benefit the country generally, by offering to landowners and others interested in the subject a much-needed object-lesson in modern scientific sylviculture. It is well known that in all the principal forest schools throughout the world, forests are set apart in this way for instructional purposes, the work in them being conducted in such manner as to secure to the fullest extent the efficient training of the students.

It is also the case that the proper prosecution of sylviculture has added greatly to the resources of those countries where it has received due attention. In Germany and France, for example, it has become a great rural industry, and is highly remunerative. According to competent experts there are many waste tracts in Scotland which if afforested would similarly become a source of wealth to our country.

M. C. Taylor,
Secretary, University Court.

University of Edinburgh,
9th June 1902.

Appendix XXIII.

APPENDIX, No. XXIII.

INSTRUCTION IN FORESTRY AT GIESSEN UNIVERSITY.

I.—*Regulations Concerning Academic Membership.*

Academic membership is attained by matriculation. Candidates for admission must possess the leaving certificate of a German gymnasium (or educational institution of similar standing), exception being made in the case of other persons who can supply evidence of scientific training to the satisfaction of the Rector.

The matriculation fee is 20 marks (£1), or 10 marks (10s.) in the case of students who have already attended another university.

Academic membership gives the right of attendance at lectures, and the use of the University institutes* so far as provided by the special regulations of these institutes.

Attendance at individual lectures is also permitted to unmatriculated persons.

Every matriculated student must enter himself for at least one course of lectures (except during the terms when he is preparing for a State or University examination).

II.—*Regulations as to Fees.*

The lecture fee is 8 marks (8s.) per term for one hour weekly, and 3 marks for every hour beyond the first. For such lectures as entail special work (demonstrations) or outlay (excursions) on the part of the teacher, twice the normal fee may be charged. These normal fees do not apply to the use of the institutes. For a second attendance at the same course of lectures, only half the fee is charged, but there is no reduction in the fee for the practical work.

III.—*Library Regulations.*

The University Library is open daily from 9 to 1 and 3 to 6, except Sundays and holidays. During the spring and autumn holidays, and from Christmas to January 1, it is closed in the afternoon. It is open to all students upon delivery of a ticket to the Library and upon observance of the Library rules.

IV.—*Regulations of* 13 *June*, 1900, *Concerning University Examination of Candidates for Admission to the Forest Service.*

These examinations are two: a preliminary and a special. The preliminary can be taken at any time, but the candidate must be a matriculated student and have resided in Giessen since his matriculation. The special can only be taken after three years' attendance at a German university or institution of similar standing: candidates must have previously passed the preliminary examination. The fee for the preliminary is 42 marks (£2 2s.), that for the special 36 marks (£1 16s.). Both examinations are held twice a year at the commencement of each session.

The preliminary examination comprises (1) pure mathematics, including algebra, analytical geometry, and the elements of differential and integral calculus; (2) elementary surveying; (3) physics, including mechanics; (4) chemistry and technical chemistry; (5) general botany, forest botany, and forest climatology; (6) geology and forest soils.

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* "Institute" is a comprehensive term to denote the buildings, apparatus, etc., requisite for instruction in a particular faculty. It is an integral part of the University. Cf. later the definition of the "Forestry Institute."

The special examination comprises:

(1) Forestry:—

(i.) General knowledge and methods of forestry, including forest history;

(ii.) Special subjects:—(a) Production, comprising forest cultivation, protection (including forest entomology), utilisation of forests and forest technology; (b) Management, comprising forest working plans, valuation, and financial aspects of tree growth; (c) Engineering, comprising the construction of forest roads, forest surveying, forest division, mensuration of timber; (d) Administration, comprising forest economy and economics; (e) Chase and fishing;

(2) Political economy (theoretical economics and outlines of finance);

(3) Agricultural science (especially management of meadows);

(4) General law.

The requisite proficiency in plan-drawing may be tested, as preferred, either in the above examination, or later, when the candidate presents himself for the State examination.

All examinations are both written and *vivâ voce*. The number of questions in the written examinations is generally 2 to 4 in each subject, and 15 to 20 in forestry. The *vivâ voce* examinations are public. The marks given are I. (very good), II. (good), III. (sufficient), and IV. (insufficient), and intermediate marks. Candidates obtaining a mark below III. are rejected, and must undergo the whole examination again. As a rule no candidate may try more than three times.

V.—*Regulations for Graduating as Doctor of Philosophy (Ph.D.).*

The following subjects are accepted for a degree:—Philosophy; mathematics; physics; chemistry; mineralogy or geology; botany; zoology; geography; political economy; forestry; agriculture; history; art; and ancient and modern languages. Three of these must be taken, one as a chief subject, and two as subordinates, the selection of the latter being subject to the approval of the authorities. The candidate must present a dissertation in his chief subject, or a work already published may be accepted, and there is a *vivâ voce* examination in the three subjects. In place of this *vivâ voce*, the special (forestry) examination will be accepted, provided the candidate obtained a mark above II. (good); the three subjects for the degree must in this case be political economy, forestry, and agriculture.

The fees for the degree amount to 325 marks (£16 5s.).

VI.—*Special Regulations Concerning Forestry Instruction.*

A special two years' course of lectures and practical work is arranged and published by the two professors of forestry. There is no compulsion to attend the whole of these courses. Upon demand every student will be given a half-yearly certificate of his attendance at the lectures and practical work.

The lectures in the summer term last from the end of April till the first half of August; those in the winter term from the first half of October to the first half of March.

The aids to instruction in forestry comprise:—

(a) Collections of objects of natural history (mammals, birds, insects, objects of animal food, plants, seeds, fungi, woods, charcoals, barks, peat, minerals, soils, etc.);

(b) Forest implements, machines, and models;

(c) A library of forestry, partly in the University Library, and partly in the forestry department;

(d) The University experiment station of 16½ acres, with special laboratory and lecture room.

These together make up the academic "Forestry Institute," which is under the direction of one of the professors of forestry. The other members of the staff comprise an assistant to the professors, the keeper of the arboretum, and his assistant.

The practical instruction is divided between the two professors. The practical work and excursions take place as a rule on Wednesdays (on questions connected with forest management) and Saturdays (on questions connected with forest production). In addition, during Whitsuntide, or immediately after the close of the summer term, a tour of 8 to 14 days is arranged in some interesting forest region under the guidance of one of the professors, who undertake this work in turn.

An area of about 620 acres in the neighbourhood, allotted to the Forestry Institute, offers the students opportunity of practice in "the chase."

Since May, 1882, a forestry research laboratory has been attached to the institute, thereby offering the students opportunity to make themselves acquainted with the conditions and work of such research.

GIESSEN UNIVERSITY:—SCHEME OF LECTURES, &c., IN 1901–3.

(a) Dr. Hess's Lectures.

		Hours per week.
Summer, 1901 - - -	(1) General and systematic forestry - - -	2
	(2) Sylviculture, with demonstrations - - -	6
	(3) Practical work on Sylviculture - - -	Saturday afternoons.
Winter, 1901–2 - - -	(1) Utilisation of forests, with demonstrations -	7
	(2) Discussion upon systematic forestry and production.	2
	(3) Practical work on utilisation of forests - -	Saturday afternoons.
Summer, 1902 - - -	(1) Protection of forests, including Forest Entomology, with demonstrations.	8
	(2) Practical work on Sylviculture - - -	Saturday afternoons.
Winter, 1902–3 - - -	(1) Forest economics, including forest laws -	6
	(2) Forest technology, with demonstrations - -	3
	(3) Practical work on utilisation of forests - -	Saturday afternoons.

Appendix XXIII.

(*b*) Dr. Wimmenauer's Lectures.

		Hours per week.
Summer, 1901 - - -	(1) Chase and fishing - - - - - - -	3
	(2) Valuation of forests - - - - - -	3
	(3) Forest surveying and division - - -	3
	Do. with practical work in the forest -	Wednesday afternoons.
Winter, 1901-2 - -	(1) Mensuration of timber - - -	3
	(2) Forest book keeping, with practical work -	2
	(3) Forest working plans according to Hessian methods.	2
	Do. with practical examples - -	Wednesday afternoons.
	(4) Instruction in drawing plans for foresters and civil servants.	3
Summer, 1902 - -	(1) Construction of forest roads - - - - -	4
	Do. with practical work in the forest -	Wednesday afternoons.
	(2) Forest working plans - - - - - -	4
Winter, 1902-3 - - -	(1) Forest administration - - - -	2
	(2) Forest history and statistics - - - -	2
	(3) Practical work in forest management - -	2
	Do. with excursions - - - - - -	Wednesday afternoons.
	(4) Instruction in drawing plans for foresters and civil servants.	3

THE UNIVERSITY FOREST EXPERIMENTAL STATION AT GIESSEN.

The principal objects of this station (*Forstgarten*) are:—

(1) To give opportunities for demonstration, experiment, and practical instruction in forestry.

(2) To give the students opportunity of studying the botanical characteristics of indigenous and the more important exotic trees.

(3) To supply plants for the station itself and for the practical work of the students, the surplus stock being disposed of amongst the owners of private woodlands and gardens.

(4) To encourage the cultivation of fruit trees and the more important kinds of exotic timber trees.

The plots are necessarily small, in order to exhibit as much variety as possible as regards kind of trees, mixtures, methods of establishing, sowing, and planting of trees, and density of stocking.

The funds for maintaining the experiment and demonstration areas are provided by the State.

The whole area amounts to 6·7066 hectares (16½ acres), of which about 12 acres are actually planted, and 2¼ acres are glades, paths, and ditches.

The total area is divided into five sections and 59 sub-sections, some of which are further sub-divided.

The experiment station is partly on the tertiary formation and partly on basalt, so that there is great diversity in the chemical and physical properties of the soil.

The conduct of the principal operations and the supervision of the staff are entrusted to a director, who is one of the University Professors of Forestry. A foreman resides on the premises; he has a fixed salary, free lodging, and 1¼ acres of land for his own use.

The buildings consist of a lecture-room, the director's private room, the overseer's dwelling-house and outbuildings (stabling, barn, and woodshed), and also a laboratory or workshop, which is used for the storage of implements, tools, forestry specimens, seeds, etc.

As already mentioned, the station is divided into five sections. It may be noted that in all cases the outlay incurred on every piece of work (whether for purposes of experiment or demonstration, or not), and any receipts which may have accrued, are minutely recorded.

Section 1 (about 5 acres) is mainly devoted to arboriculture, and thus presents a somewhat park-like appearance; a pond and the buildings are also in this section. It contain 220 species and varieties, some of which have already developed into stately trees. This section is divided into 24 sub-sections. One of these consists of 55-year-old silver firs of good growth, under 15 oaks nearly 150 years old, with a few suppressed Norway spruce. This is an example of under-planting a light tree (the oak) with a shade species (the silver fir). Another sub-section is a mixture of oak, ash, alder, rowan, and sycamore of good growth, with a row of poplars and willows. On the remainder of this section the growth of individual trees is more particularly aimed at, so that number and variety of species is the chief object.

Section 2 (about 3 acres).—One sub-section is devoted to experiments in three different ways of sowing oaks (in rows, patches, and broadcast), partly altogether in the open, partly under side shade, and partly under complete shade, with the view of ultimately comparing their growth. In other subsections there have been planted pine, birch, larch, lime, and ash, either pure or mixed, with similar objects. Investigations as to the advantage of pruning oak and lime, and whether grass should be allowed to grow under ash, are also conducted.

Section 3 (about 3½ acres).—This is chiefly planted with silver fir, hornbeam, ash, Norway spruce, alder, and some mixtures. Besides experiments in the method of planting, silver fir and ash are grown with and without grass under them, and experiments in thinning and pruning are carried out in the case of Norway spruce.

Section 4 (about 2½ acres).—The trees here are chiefly Norway spruce, oak, silver fir, black Austrian pine, lime, poplar, willow, and some mixtures. The objects aimed at, besides method of planting in all cases, include the determination of the best time for planting (autumn or spring) thinning and pruning, etc. This section includes also a nursery, examples of fencing, and an artificial hill chiefly planted with mountain pine.

Section 5 (about 2½ acres).—This section is attached to the Forest-research Laboratory, and is devoted partly to the raising of exotic trees, and partly to their cultivation in the open. The general conditions of their growth are observed, and they are also used for demonstration purposes. The varieties mostly grown here are Weymouth pine, Californian maple, Douglas pine, Sitka spruce, Nordmann's pine, Corsican pine, white hickory, and black walnut.

The enclosure of the whole station has formed the object of experiment. It is surrounded partly by hedge and partly by fence. Where the fence occurs the posts consist of twelve different kinds of wood—larch, silver fir, Norway spruce, Scots fir, Weymouth pine, black Austrian pine, oak, beech, ash, alder, acacia, white beam. Observations are made on the durability of the various species, and as the posts have been cut from different parts of the stem (butt, middle, top) and have been subjected to varying treatment (charred, tarred, impregnated, painted, etc.), information on these points is also obtained. Different types of paling and various hedge-plants are also being tested.

Appendix XXIV.

APPENDIX, No. XXIV.

Programme and Regulations of the Bavarian Lower Schools of Forestry (*Waldbauschulen*)

The aim of these schools is to prepare young men for admission to the executive and protective staff of the State forests of the Kingdom. They are intended to give the pupils such a measure of general and technical knowledge as is indispensable for their future calling; and also to further the moral character of the pupil, to accustom him to obedience, punctuality, endurance in labour, and capacity for bodily exertion, and to awake in him a love of his work in the forest.

Each school is established at the headquarters of a forest district, and as regards immediate control is under the Forest-Director of the district. The schools are under the Forestry Department of the Ministry of Finance.

The instruction given comprises: (1) Religion, (2) general subjects (complementary to the education provided in the public elementary schools), viz., writing, German, arithmetic, geography and history, natural science, and drawing; (3) technical instruction. The latter is given partly in the school and partly in the forest.

The technical instruction comprises: (1) Calculation of areas, measurement of the cubic contents of trees, ditches, etc., calculation of the requisite quantities of various plants on given areas, and their distance apart, levelling and measurement of heights of trees with simple instruments; (2) the more important trees and their habit of growth, culture, seeds, forest weeds, technical properties and uses of timbers, and the essentials of fruit culture; (3) principal soils; (4) management, regeneration and systems of felling, raising trees from seeds, cuttings, layers, etc., and the common implements of forest culture; (5) operations of felling, working up, and haulage of wood, and the rules concerning them, practical road-making, harvesting, and preserving seeds and bark, the action of forest-humus and the effects of its removal, the utilisation of peat, windfallen wood, pasture, and grass; (6) injury to forests from man, animals, plants, or physical causes, with preventive and remedial measures, laws and regulations concening forests and foresters; (7) forms, observances, and laws relating to the chase, practice in shooting; (8) the principles of working-plans and the rules concerning boundaries and division of forests, forest mensuration, and the methods of estimating the annual fellings; (9) service regulations of the Bavarian forest service; (10) recording transactions, preparation of reports, registers, diaries, accounts, etc; (11) free-hand and map-drawing, particularly copying plans of estates, preparation of surveys for sales, etc.; (12) popular law.

There are four classes, and the number of hours devoted to each branch of study is as follows:—

—	Number of Hours per week.			
	1st Class.	2nd Class.	3rd Class.	4th Class.
(*a*) Religion	2	2	2	2
(*b*) General subjects	11	9	5	3
(*c*) Technical instruction, viz.:				
(1) Sciences bearing on Forestry	1	2	3	3
(2) Forestry proper	1	2	5	7
Total	15	15	15	15

In addition to the work done in the school, as much study and practical work as possible is to be done in the forest. Other hours are set apart for private study. Further details of the work are drawn up by decree of the Ministry of Finance.

The teaching staff consists of (1) the director of the local forest district, (2) an assistant forest officer, (3) a master for the general subjects, (4) the local Catholic and Protestant clergymen, (5) an assistant master for technical subjects, and (6) an assistant master for the general subjects.

Boys commence in the first class, in which, as a rule, not more than ten pupils are admitted. Candidates for admission must be between 13 and 16 years of age, be Bavarian subjects, have duly completed their education in the elementary school, and be of sound constitution, particularly as regards eyesight and hearing. They are required to complete the whole school course. The pupils lodge and board with families in the neighbourhood, the family selected being subject to the approval of the director.

The winter term lasts from the 18th September till the Friday before Palm Sunday (with a ten days' break at Christmas); the summer term from the second Tuesday after Easter until the 14th July.

There is an entrance examination—in the subjects taught at the elementary schools—and a final examination upon completion of the course. The latter is intended to test the fitness of the fourth class students to enter the lower grade forest service of the State; its scope embraces the whole of the instruction given in the school, and is both written and *vivâ voce*. The written examination is conducted by the masters in each subject with the aid of another member of the staff nominated by the director. The *vivâ voce* examination is conducted by a committee, and is divided into two parts of one hour each, one in the school and the other in the forest. As a rule, the examiners in the school are the masters in each subject. The committee determines the results of the written and oral examinations, and decides whether the candidates have passed. This committee consists of the head officer (*Oberforstrath*) of the district, or his representative, the director, and the other members of the teaching staff.

Half-yearly, annual (for the three lower classes), and leaving certificates are given. The first of these merely records the pupil's conduct and diligence; the annual certificate shows his marks for conduct, diligence, and progress in each branch of study, together with an average mark and a statement as to fitness to enter the next class. The leaving certificate records the result of the final examination, with a statement of his conduct and diligence during the whole of his time and of his fitness for State service.

The entrance fee is 3s., and the annual tuition fee £1, payable in ten monthly instalments. A fee of 6d. is payable for the half-yearly certificate, 1s. for the annual, and 2s. for the leaving certificate.

Appendix XXV.

APPENDIX No. XXV

INFORMATION as to the ASSISTANCE, by means of LOANS, INSPECTION, REMISSION of TAXATION, etc., that FOREIGN STATES give to planters, and the ENCOURAGEMENT they offer to the AFFORESTATION of WASTE LANDS. By Dr. ADAM SCHWAPPACH, Director of the Prussian Forestry Investigation and Professor of Sylviculture at the State School of Forestry, Eberswalde.

In proportion as population grows, as the employment of wood for industrial purposes increases, and as the natural supplies of wood tend to become exhausted, greater attention is paid by Governments to the maintenance and better management of the woods still remaining and to the formation of new woods.

Afforestation is undertaken (a) by private proprietors, (b) by co-operative or communal bodies, (c) by the State itself. In this connection the formation of forests by private proprietors falls to be considered first.

In former times it was believed that even private afforestation could best be secured by legal compulsion. In the older forest laws we often find regulations that "the waste lands" must be sown or planted. The results obtained in this manner were, however, small; besides, measures of that kind correspond no longer to modern views. In recent times, therefore, encouragement to State afforestation on private lands has been given partly by instruction and partly by subventions.

To induce the formation of new woodlands by private proprietors, it is necessary first to convince them of the use of the forest, and then, when the inclination to afforest exists, to teach them how the forest is to be formed and subsequently managed. The first of these tasks is greater and more difficult in proportion as a country is little wooded and its forestry has been hitherto bad.

An interesting example of these conditions is afforded by the United States of North America, where the movement in favour of afforestation has been growing steadily for about 10 years past. It is there ably impressed upon the people in journals and pamphlets that the formation and management of woods is a thoroughly profitable business.

Besides these methods, discussions and transactions of societies and meetings also play an important part. These latter are especially important in connection with the spread of knowledge of the most appropriate methods of forming and managing woods.

Where there is a State forest staff, the officials generally consider it an honour to help in the spread of a knowledge of forestry in societies and meetings. In States where no such staff exists special officials are frequently appointed for this purpose.

Thus the chief task of the Bureau of Forestry in the United States Department of Agriculture consists in the spread of forest knowledge and in the advancement of afforestation. In Russia, by the Order of 23rd January, 1888, forest divisional instructors have been introduced, with the following duties: (1) To give oral and written advice concerning forestry, (2) to inspect State and private forests, and (3) to guide the execution of forest operations of all kinds. In Austria the technical forest staff of the administration has the duty of . . . (2) encouraging forestry by the instruction of forest owners who stand in need of teaching or guidance. In Bavaria nine forest officials have been appointed within the last two years, in districts where there are no State forests, with the sole object of encouraging forestry and carrying out the forest administration.

An increase of forest knowledge by providing instruction in the elements of sylviculture in farm schools and agricultural colleges is also very necessary. Such work has grown in a marked manner in recent years in Germany.

Private proprietors and the employees of small owners have often but little knowledge of forestry, and it has been found most useful to bring the foresters of small owners together for a practical course of a week or so, during which they themselves perform forestry operations under proper guidance, receive a few hours of lecture-room instruction, and make excursions.

It may also be mentioned that at the chief Agricultural College of Austria there are annually held courses of two weeks' duration. These are of the nature of vacation courses, and embrace class-room instruction and excursions. These are designed for forest owners and the members of their higher forest staff.

The appointment and pay of officials who in the manner described above provide for the spread of a knowledge of forestry forms one of the chief means by which the area under forest may be increased. Of what use are the most munificent subsidies when either the will or the capacity for their proper application is wanting?

I shall return later to the benefits derived from the appointment, by several Prussian Chambers of Agriculture, of "forest advisers."

Material assistance towards afforestation is given in many States by the grant of monetary premiums.

Thus in Prussia the State has long paid from a half to two-thirds of the cost of cultivation (on the average of late years 12s. per acre) in districts where the afforestation of private or communal land seemed especially desirable. With such State assistance over 27,000 acres have been afforested in Prussia during the years 1882–94 (outside the Eifel, Hohe Venn, and Westerwald, to which special funds are allocated). The total amount paid during this time for the promotion of private woods on waste land amounted to £55,500.

In Russia there are annually granted for forest cultivation and rational wood formation 140 premiums, each of 100 roubles, with a silver medal; two premiums of 500 and two of 300 half-imperials, each with a gold medal. The Hungarian Minister of Agriculture annually awards six principal and six minor premiums for afforestation. Two premiums are of 1,000 crowns each, two of 800 crowns each, and the smaller of about 100 crowns each.

Such assistance is always given on an exceptionally large scale wherever it is a question of forming protective woods. The oldest law providing for this encouragement is the French, of 28th July, 1860, which says in Art. 1: Subventions may be granted to communes, public establishments, and individuals for the re-afforestation of ground on the summits or slopes of mountains. These subventions consist either of a grant of seeds or plants, or of a money premium. According to Demontzey ("L'extinction des torrents én France par le reboisement," Paris, 1894), 156,885 acres have been afforested in France since the law came into force with optional State subventions, of which 67,125 acres belonged to private individuals. The State contributions amounted to about 22s. per acre on the average or 50 per cent. of the cost.

Another form of State assistance is common in the United States of North America, where the normal size (160 acres) of a farm under the Homestead Act was quadrupled if the acquirer undertook to afforest a portion. The results obtained thus are nevertheless small, as in most cases there were wanting the knowledge, and often the will, necessary for afforestation.

In many States, as in Prussia, Bavaria, Saxony, Hesse, there exist special credit institutions, or agricultural banks, possessing a State character, for the encouragement of the cultivation of the soil, under which term is included the afforestation of waste lands. These banks give loans for such purposes at moderate interest (3½ to 4½ per cent.), plus ½ per cent. for redemption of loans. Very little use has, however, up to the present been made of them for forestry purposes. Otherwise, loans are only granted for the formation of protective forests (*e.g.*, Hungary).

Remission of taxation for new afforestation is found only in a few countries, and mostly only for protective forests. Only in Baden is there exemption from taxation during 20 years for all new woodlands. Hungary admits a reduced taxation on all forests managed on regular working plans. In France plantations on the summits and slopes of mountains, and on dunes and heaths, are exempted from taxation for 30 years. In

Russia and Hungary protective forests generally enjoy complete exemption from taxation.

The method of encouraging private forestry, but more especially the formation of new woods, by distributing plants and often seeds, either gratis or at much reduced prices, is very widespread. In Prussia, for instance, up to 100 million young forest trees are distributed every year under these conditions. In 1893-4 there were distributed 2,038,142 young hard woods, and 29,898,350 conifers for £3,929.

In many districts of Germany, where property is much sub-divided, and afforestation is peculiarly difficult for private individuals owing to want of knowledge and means, afforestation societies have been formed, as in Westphalia, Hanover, Schleswig-Holstein. These societies are not only subsidised with money, as described above, by the State and local administrative bodies similar to English County Councils, but are in a position to purchase seeds upon a co-operative basis at low prices, to grow the plants in their own nurseries, and distribute them to members. These societies are sufficiently well off to secure experts at their own expense, who, by teaching and inspecting, watch over the correct and successful treatment of the woods.

In course of time, and especially in the interests of the owners of private woods, necessity has effected, through the agency of State-aided special control stations, the placing of the tree-seed industry in the same position as agricultural seeds.

France was the first to introduce such a seed-control station for tree-seeds at Barres-Vilmorin. The seed control stations at Zürich and Tharand, especially the former, occupy themselves to an increasing degree with the examination of such seeds. Special control stations for tree seeds have further been instituted in connection with the forest experimental stations, in 1889 at Mariabrunn for Austria, and in 1900 at Eberswalde for Prussia.

The results up to the present clearly show how extraordinarily valuable, particularly for private owners, such institutions are; for the seed merchants are not always sufficiently trustworthy, and the private individual is not in such a favourable position as the State to secure protection against deficient consignments.

Given the presence of a State staff of forest officers, it is important that these should have a general permission to undertake the management of private woods already in existence as a secondary occupation, so far as their main occupation permits. The example also given by Saxony, where the State Forestry Bureau undertakes the preparation of working plans, and the regulation of the management for private wood owners for a small remuneration, is greatly to be recommended.

In various German States, for instance, in Hesse and Baden, the private forests are organised by the State; so that there, within a conveniently situated group of private forests, belonging to various owners, the supervision is performed on a co-operative basis by a single official.

From the preceding short review of the various means adopted for the encouragement of afforestation, it appears that, from the point of view of material, as contrasted with advisory, assistance, the most important by far is the bearing by the State of a part of the cost of culture. For obvious reasons, however, this form of encouragement has its limits. To pay 50-70 per cent. of the costs of cultivation is the rule; the State only goes beyond this amount where the public interest specially demands it, as in the case of protective forests. It is not advisable for the State contribution to fall much short of 50 per cent., for then the inducement to afforest becomes too small.

It must be emphasised, however, that even the most thorough-going State subsidisation will be unsuccessful if the people do not understand the value of forests; or if they have not the knowledge necessary for the proper execution of the work, cannot select suitable species or manage the forest, when formed, properly. Hence, in most recent times, and especially in Germany, but also in other countries, notably the United States of North America, the endeavour is made, not only to spread an ever-widening knowledge of the importance and profits of woodland, but also to create a staff which is ready and qualified to be active in this direction, and to be at all times at the side of the private individual with counsel and instruction. In this connection, reference may be again made to the Forestry Bureau of the United States Department of Agriculture, which is seeking to create such a staff in its field assistants. The most complete system seems to me to be the system of forestry advisers, which has existed for some years past in connection with several of the Prussian Chambers of Agriculture, and which I shall now shortly describe.

Since 1895 the former agricultural societies in Prussia have been definitely organised as Chambers of Agriculture, and act as the official representatives of agriculture and forestry in their districts. To defray the expenses necessary in furthering their aims, they have at their disposal means, partly assigned by the State or provincial Government, and partly derived from contributions levied upon the agricultural and forestry industry in their districts.

Various Chambers of Agriculture (that of Brandenburg being the first, in 1899) have now, in order to advance private forestry, appointed their own technically educated forest officials, with the title "Forest Adviser." The salary (£200-250 per annum) of this official is paid by the Chamber, and he also receives out-of-pocket travelling expenses, and 15s. for subsistence per day. His task consists in the first place in giving information on every possible subject connected with forestry to private proprietors, partly in writing, and partly orally, after an inspection on the spot. If a visit is necessary, the proprietor bears the cost of travelling and subsistence. Besides, the forest adviser must, on his own initiative, take such steps as are calculated to advance forestry. The principal of these are giving lectures at meetings of agricultural societies, instituting courses for the staffs of forest owners, and, if desired, for the latter also, arranging for the co-operative purchase of good seeds and plants, facilitating the sale of wood by publication of current prices, etc.

In Brandenburg, with 783,000 acres of private forests, the Chamber of Agriculture has at its disposal for forestry purposes, £250 from the State, £150 from the province, and £250 from its own funds, or a total of £650* annually. The above-mentioned State subventions in aid of afforestation, which are paid directly to the owners of the land, are not included in this sum. This sum of £650 is sufficient to cover the salary and travelling expenses of the forest adviser, so that proprietors desirous of consulting him have only to defray his costs of subsistence. These costs are by convenient combination of different journeys reduced as far as possible.

This system has rapidly acquired great popularity. The officer concerned was out for 120 days in 1901, and it has already become necessary to appoint a second official, whose chief duty it is to work out the details of working plans.

For private proprietors the great advantage follows, that they have at all times at their disposition a qualified person for an insignificant payment; on the other hand, forestry receives a great stimulus from the lectures and courses given by a man intimately associated with local conditions.

For English conditions it seems to me that the creation of posts on the pattern of the forest advisers, and filling them with young and diligent persons, knowing Continental conditions from personal acquaintance, and, above all, practically entrusted with methods of forest culture, would be of the greatest importance.

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* In comparing this sum with the area under forests, it is to be noted that at least 40 per cent. of the wooded area belongs to large proprietors, who, with their own staff, are able to manage their forests in a fairly satisfactory manner, and who would therefore require no financial assistance from the Chamber.

Appendix XXVI.

APPENDIX XXVI.

A Review of the Restrictions, in the Public Interest, that States place upon Private Owners of Forests. By Dr. Adam Schwappach, Director of the Prussian Forestry Investigation, and Professor of Sylviculture at the State School of Forestry, Eberswalde.

There are two fundamentally different systems in administrative legislation dealing with forests belonging to private individuals.

(1) The first system leaves the owner an entirely free hand in the management of his woods and the utilisation of their produce, provided the public interest does not necessitate any restrictions. Public interests demand restrictions in the management of private woods only when such woods are protective. Woods are said to be protective when from their situation and the nature of the land enclosed within them, they are of importance to the cultivation, not only of the land that they enclose, but also of neighbouring land, or of land at a distance (*e.g.*, land liable to floods).

The protective action of a wood consists mainly in binding the soil. Thus in the plains protective forests occur chiefly on light sand which has a tendency to drift ("flying sand"), while on mountains and hills they are chiefly concerned with preventing torrential floods or the washing away of soil.

(2) The second system aims at applying the limitations on private forestry—to be described further on—either wholly or partly to all forests without distinguishing those which are protective. This system is the older, and is indigenous more particularly in those countries where the State has for centuries exercised an influence on private forestry. It has recently attained some academic interest, because the distinction between protective and other woods is beset with difficulties; so that woodlands are sometimes defined as protective whose action in this respect is not obvious, but which a wider knowledge may one day show to be so.

In Germany it is only in the central and southern states that there is State interference with private woodlands; and there 29·7 per cent. of the total private forests of Germany, or 14·6 per cent. of the total forest area, is under State control; 70·3 per cent. of the private forests being subject to no legislative restrictions whatever, in so far as they are not protective forests (Prussian and Saxony). Outside Germany freedom as regards the management of private forests (except when these are protective) is unrestricted in, for example, Hungary, France, Italy, the lowlands of Switzerland, and in Sweden. The latest Bill for an Italian forest law, however, proposes State supervision of all woods.

The following State measures restricting the free management of private woods (apart from legislation concerning protective forests) may be enumerated:—

(1) Prohibition of deforestation, *i.e.*, the prohibition to apply areas, hitherto used as forest, permanently to other uses after removal of the stock of trees. This regulation is, in and out of Germany, still the most widespread, and comparatively the easiest to carry into effect. It is found in, *inter alia*, Bavaria, Wurtemburg, Baden, Austria, and Russia.

The prohibition to deforest is, nevertheless, nowhere absolute, but the process may be anywhere permitted under certain conditions. In most cases it must be shown that the area shall permanently give a higher return when applied to other purposes, also that the removal of the wood shall in no way injure public or private interests. Besides this, the following regulations may be mentioned:—Deforestation is permitted (a) if an area of similar character is elsewhere appropriated to the growth of trees (Russia, some cantons in Switzerland and Hesse), (b) if the area is only small (Hesse, where isolated patches of wood not exceeding 6¼ acres, may be so treated), (c) if the area is to be used for roads or rectification of boundaries (Brunswick, Russia). As a further example, it may be mentioned that the Russian law of 1888, Article 11., further lays down that deforestation is permissible in dividing a property and in artificially afforested plots, if the stock of wood has not attained more than 20 years of age.

(2) The requirement to afforest exists according to present forest legislation only in the compulsory re-afforestation of woods which have been felled, generally within a definite time after the utilisation of the old stock (Wurtemberg, Bavaria, Baden).

Afforestation of new areas which were not previously under wood is only required by laws dealing with protective woods and the regulation of torrents (Switzerland, Prussia, France, Italy, Hungary).

The effective application of laws relating to compulsory afforestation presupposes that the forest authorities possess the power of compulsory intervention in case of necessity, and of executing the work with their own staff at the expense of the negligent owner. Practically this compulsory afforestation is very difficult to carry out, since by simply leaving a few seed trees, by strewing the area with birch seeds, or by allowing stool shoots to grow up, the actual letter of the law can be satisfied, while really letting the land go to waste.

(3) Prohibition as regards careless or injurious management. In previous centuries there was already a desire to render secure, by means of administrative regulations, as well as State supervision, not only the continuance of forests, but also their proper treatment. Modern laws designed to secure good management are in many cases founded on these old enactments.

Modern requirements are of an exclusively negative character, and prohibit treatment which would result in the destruction or degradation of the forest. The following may be noticed: (*a*) Irrational utilisation, as by over thinning or the felling of immature trees; and (*b*) diminution of the productive capacity of the soil, for example, by the unregulated withdrawal of litter, by neglect to restock denuded areas, etc.

Forest laws have sometimes had regard to the former, sometimes to the latter of these objects. Thus, for example, the Baden forest law prescribes that the forest authorities should intervene in cases where forests are being ruined by mismanagement; the Russian law of 4th April, 1888, forbids, in Art. 13, even in non-protective woods, "clear-fellings conducted in such a manner as to ruin the factors of production, and so to render natural regeneration impossible, and to transform clearings into barren areas."

The Bavarian, Hessian, and Austrian laws, on the other hand, understand by forest degradation or deterioration treatment which would result in a diminution of the productive capacity of the soil, or an entire destruction of the fertility of the soil.

However desirable in the general interest may be the proper treatment of all woodlands, it is difficult, if not impossible, to attain this end by legislative compulsion.

The idea of forest degradation, to the prevention of which States now limit themselves, is very elastic, and can hardly be so sharply defined from the legal point of view as to admit of a judicial, impartial execution, which shall be free from administrative jobbery. It was owing to the fear of such inconveniences that the Prussian Government lately failed in its attempt to grant its subsidies for afforestation only upon the condition that the woods so aided must be subjected to the supervision of the State. Owners have preferred to renounce the subsidy rather than subject themselves to this supervision.

Peculiar difficulties result from the fact that decisions as to the permissibility or otherwise of the measures under consideration are made, as a rule, from the standpoint of the large permanent forests, while the woods of small owners often acquire value and importance solely through being treated in a fashion which is inadmissible on large estates.

The opinion of the Council of the Empire annexed to the Russian law of 1888 accordingly expressly excludes from the above-mentioned provisions for the protection of woods those forests which have been handed over to the peasants by deed and legal enactments for the improvement of agricultural industry.

Finally, against a prohibition to allow woods to degrade or deteriorate there is to be urged the difficulty of carrying it into effect. The supervision of private forests can only be performed by a special technically educated staff, which is nowhere at the disposal of the authorities in sufficient numbers for this purpose; not

Appendix XXVI.

even in Austria, which possesses its own technical forest officials in the administration.

(4) In previous centuries there were also numerous positive prescriptions relating to the time of felling, the manner of felling, and method of management, which have almost completely disappeared from modern forest laws.

Among more recent laws, only that of Reuss, a small State in Germany (1893) prohibits clear-felling without special permission; in Russia and Schwarzburg-Sondershausen definite wording plans must be prepared and followed; the latest Bill of an Italian forest law provides, in definite cases, for the issue of regulations concerning management in case of necessity from time to time. The Austrian law of 1852 prescribes, in Sections 5-7, particular methods of management for woods on drifting sands, on the banks of the larger sheets of water, as well as where danger to neighbouring forests from wind would result from clearing. These last measures must be regarded as intermediate between freedom of action and the restrictions associated with protective forests.

(5) In regard to administration, various forest laws also contain certain provisions:—

(*a*) In Austria and Hungary the owners of some classes of private woods must appoint forest officers, who have fulfilled certain requirements as to their education and training. In Austria, this holds for the larger forests. The determination of the minimum size of these forests is left to the particular provinces. In Hungary the owners of entailed woods and of common woods, as well as mining companies and the proprietors of similar industrial undertakings, are subject to these provisions.

(*b*) The compulsory taking over of the management of private forests by the State on account of illegal treatment by the owners is a penalty imposed in Wurtemberg, Baden, and Lippe-Detmold.

(*c*) In many States private owners are obliged to provide the necessary staff to protect their forests, just as in others they have to appoint foresters with certain qualifications; for example, in Baden and Russia. In Austria and Hungary this provision holds at least with reference to those forests for which there exists an obligation to appoint a forest officer as shown above under (*a*).

The supervision over protective forests, where these are distinguished in legislation, is not everywhere equally vigorous.

The older laws concerning the management of protective forests aim only at maintaining the forests actually in existence. With this object they all not merely prohibit deforestation and deterioration, but also contain special provisions regarding the management. In particular, the regeneration of protective woods must be so arranged as to avoid large clear-felled areas. It must, in fact, be accomplished either on the shelter wood compartment system, or in the band or strip system (Austria, Bavaria, Wurtemberg).

The more recent forest laws mostly avoid such general provisions concerning management, and leave the measures to be taken in each particular case to the authorities entrusted with the execution of forest protective laws (Prussia, Russia, and France), or authorise such further measures in addition to certain general provisions (Switzerland, Italy).

Recent protective forest legislation, however, also aims at the creation of such protective forests. Legal compulsion to afforest is implied in all those laws which leave the executive authorities a free hand with regard to the management of protective forests; it is thus in France, Austria (law concerning the regulation of torrents, 30th June, 1884), Switzerland, Italy, Hungary, and Russia. This compulsory creation of woods possesses special interest in connection with the regulation of torrents, where especially the formation of new woodlands must go hand-in-hand with hydrotechnical work. In France a similar compulsion exists also for the treatment of sand dunes (Decree of 10th December, 1810, relative to the planting of dunes).

With regard to the views which exist in Germany amongst those who are specially interested in forestry upon the appropriateness of the two systems, viz. (*a*) freedom of private forestry in general, but with stringent measures for protective woods, and (*b*) administrative guardianship of private forestry, without reference to its protective properties, reference may be made to the transactions of the German Forestry Council at its sitting of 17th September, 1899, when a discussion took place upon the aims and methods of protective forest legislation in the German Empire.

The South German representatives recommended for the whole of Germany the adoption of the system there in force of general administrative supervision; but the proposals to this effect were rejected by a large majority. Solely to avoid increasing the difficulties of the Wurtemberg Government, which was preparing a revision of its forest laws, the following resolution was finally accepted by a small majority: "In view of the difficulties of a strict legal definition of protective forests, and the equally great difficulty of determining which woods in any district shall be called protective, the Forestry Council approves the principle which has found expression in the legislation of the South German States, giving the State a right of inspection over the entire forests of the country." The debate and division, however, distinctly showed that a reintroduction of State supervision in countries where it had once existed, but had been abandoned, was impracticable, and could not be recommended.

When it is considered that at this meeting, comprising the élite of the forest officers and forest proprietors of Germany, only a bare majority were found to favour general State supervision over private forests, and to support a resolution that bound no one, it is clear, without going further, what would be the fate of a similar proposal in a country like England, where the popular feeling as regards State interference with private affairs is much more antagonistic than in Germany.

Appendix XXVII.

APPENDIX No. XXVII.

Receipts and Expenses of State Forests in France and Germany.

Country.	Year.	Total Area.	Area under Wood.	Total Receipts.	Total Expenses.	Net Receipts.	Net Receipts	
							Per Acre of Total Area.	Per Acre of Area under Wood.
		Acres.	Acres.	£.	£.	£.	£. s. d.	£. s. d.
France	1892	2,690,067	*2,205,283	1,046,120	—	—	—	—
Germany:								
Prussia	1899	6,914,063	6,203,516	4,350,660	2,182,443	2,168,217	- 6 3	- 6 8
Bavaria	1898	2,312,325	2,053,049	1,861,028	876,398	984,630	- 8 6	- 9 7
Würtemberg	1900	482,518	459,499	750,222	254,850	495,372	1 - 6	1 1 6
Saxony	1901	436,668	419,709	685,217	279,439	405,778	- 18 7	- 19 4
Baden	1900	232,373	228,442	384,586	156,854	227,732	- 19 7	- 19 11
†Alsace-Lorraine	1900-1	377,113	370,596	384,345	186,072	198,273	- 10 6	- 10 9

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* A considerable proportion of this consists of mountain land newly acquired or newly planted which as yet yields no revenue.

† Including 40,143 acres owned jointly by the State and local authorities. The State's share of the receipts and expenses is included.

Appendix XXVIII.

APPENDIX No. XXVIII.

The United States Bureau of Forestry.

(From the Year Book of the U.S. Department of Agriculture for 1901.)

The Bureau of Forestry (Forester and Chief, Mr. Gifford Pinchot) forms part of the Department of Agriculture. Until 1st July, 1901, the Bureau was only a division, but on that date it was advanced to the grade of Bureau, and provision for its expenses was made by an appropriation of £38,633.

The Bureau of Forestry is made up of the Division of Forest Management, the Division of Forest Investigation, and the Division of Records. Each of these continues, with enlarged facilities, work which was in progress under the old Division of Forestry. There were during 1901 in all 179 persons engaged in the work of the Bureau. Of this number 81 were student assistants—young men, largely college students, who expect to enter forestry as a profession, and who served during the summer on small pay for the sake of the experience gained.

The field work performed by the Division of Forest Management includes the study of forest conditions and problems all over the country, giving advice to owners of private lands, and the supervision of conservative lumbering operations which illustrate forest management on business principles.

When the owner (public or private) of woodland wishes to consider the possibility of his property if handled as a constant source of timber supply, the tract must be examined by an expert to ascertain the condition of the standing timber, the prospects of reproduction, the facilities for marketing, the best method of harvesting the present crop so as to secure the largest present and future yield, and the likelihood of success under management. A preliminary report is made. If the owner decides on management, a working plan follows. This involves a careful study of the rate of growth of the different kinds of marketable timber, the computation of the proper interval between cuttings and of the amount of timber to be harvested, and, if desired, the recommendation of the necessary regulations to enable the work to go on under contract. All this falls to the Division of Forest Management.

The Division of Forest Investigation makes studies of trees, and their rates of growth, distribution, reproduction, and habits; and investigates the forest problems connected with fires, lumbering, grazing, tree planting, stream flow, and erosion.

The Division of Records includes all office and routine matters, and also has the custody of the library of forest literature, and of a unique collection of photographs, which is continually being added to, illustrating forests and forest conditions all over the United States.

The sums entered in the appropriations of the Department of Agriculture as set apart for "forestry investigations," have been £8,333, £16,667, and £30,475 in the three years ending June 30th, 1900, 1901, and 1902 respectively. These sums are apparently exclusive of salaries.

The scope of the work performed by this Bureau is best shown by the following extract from a report of the Secretary of Agriculture upon this branch of his Department's work in 1901:—

"The work of this Bureau includes the making and execution of working plans for Federal, State, and private forest lands; the study of forests, forest fires, forest grazing, commercial trees, lumbering, and forest products; the study of economic tree-planting, and the preparation of planting plans. The Bureau is co-operating with the Federal Government, with several States, and with many private owners, in handling their forest lands. Its assistance has been asked for a total area of 52,170,036 acres, of which about 4,000,000 acres are held by lumber companies and other private owners. In its studies of commercial trees and forests it is pursuing lines of investigation indispensable to the development and perpetuation of our national forest resources. Its work of tree planting on the treeless plains already involves the making of planting plans for many thousands of acres of wood lots, shelter belts, and commercial plantations.

"On the 1st of July of the present year the Division of Forestry became a Bureau. The change was incidental to the partial reorganisation of the Department of Agriculture by Congress at its last session, but it was brought about by the increased understanding of the need of forestry among our people, and especially by the appreciation in Congress of the practical methods used by this Department in its forest work. The change from a Division to a Bureau opens a way for larger organisation and more extended work, which the public and private demands for assistance in practical forestry have made imperative. The work of the Bureau of Forestry is now conducted along three principal lines. First, forest management, which involves the preparation and execution of working plans for Federal, State, and private forest lands; second, forest investigation, which includes the study of commercial trees, of economic tree planting, of forest fires, grazing, lumbering, forest products, and other important lines of research; and third, the making and maintenance of records, which covers the routine work of the Bureau and the care of its library, laboratory, and photographic collection.

"I am glad to report that the Bureau, under its present organisation, can meet much more effectively the demands made upon it than was possible as a Division. During the fiscal year these demands have not only increased along lines already established, but the growing tendency to refer all important forest matters to the Bureau has been more marked than at any time in the past.

"The demands for the assistance and advice of the Bureau are insistent and widespread, and its sphere of usefulness has extended widely with the sound and steady development of the forest movement. With the added effectiveness of its present organisation, the adequate extension of its field force, now first made possible by the training of men in our forest schools, and the urgently growing need of its services, the Bureau of Forestry has before it a future rich in possibilities for useful work if its resources do not fall too far behind its actual needs. I have not hesitated to recommend a considerably increased appropriation for the Bureau of Forestry for the coming fiscal year, because of the vast interests which depend on forest preservation and wise use. In a very real sense an appropriation for these purposes protects and promotes the interests, among others, of all that vast body of our citizens to whom the success of irrigation, mining, grazing, transportation, or the timber trade, are of primary importance.

"The rapid progress of interest in forestry throughout the South is most gratifying. A very considerable proportion of the most important recent work of the Bureau of Forestry lies in the Southern States.

"With the view to encouraging the substitution of conservative for destructive methods, the Bureau has undertaken the preparation of working plans, giving full directions for the management of forest tracts, and will also afford practical assistance on the ground, without cost to the owners of wood lots. In the case of large tracts, however, the cost of travelling expenses and subsistence, together with the necessary helpers of the agents of the Bureau while in the field, must be borne by the owner.

"*Forest Management.*—The requests upon the Bureau of Forestry from private owners for practical assistance and advice in the handling of their forest lands continue steadily to increase. Of the recent requests for assistance the most noteworthy is the joint application of the Kirby Lumber Company and the Houston Oil Company for help in devising the best method of managing 1,000,000 acres of long-leaf pine land in Texas. This area includes considerably more than half of the long-leaf pine lands in that State.

Appendix XXVIII.

"Personal examinations in the woods were made during the year of 788,890 acres of private ownership, and four detailed working plans were prepared, covering an area of 226,000 acres. One of these was for the tract of a lumber company in Arkansas, and another for a tract in Missouri, owned by the Deering Harvester Company. The preparation of working plans was begun upon five timber tracts of private ownership, with a total area of 628,000 acres. The largest of these consists of 300,000 acres in Maine, owned by the Great Northern Paper Company. The fact that the offer of co-operation under which these working plans are made is being taken advantage of so extensively by lumber companies and other business organisations indicates clearly the real practical value of the Bureau at Forestry to private owners.

"The preparation of working plans for the federal forest reserves goes steadily on. The working plan for the Black Hills Forest reserve has been completed, and working plans have been begun for the Prescott, the Bighorn, and the Priest River forest reserves. The immense labour involved in some of these plans is indicated by the fact that for the Black Hills plan alone the diameter of every tree, large or small, was measured on 10,234 acres, and complete ring countings were made for 4,500 trees. All these field measurements require painstaking elaboration in the office.

"In co-operation with the State of New York, which appropriated $3,500 for that purpose, the field work necessary to a working plan for townships 5, 6, and 41, Hamilton County, in the Adirondack Forest Preserve, has been completed. The results of similar co-operation on township 40 have already been published in the form of a complete working plan.

"*Forest Investigation.*—Studies of commercial trees, the practical advantages of which are becoming more and more evident, were continued during the year, and extended to many species hitherto not investigated. Extensive studies of the redwood, red fir, and hemlock of the Pacific coast have been completed, and are ready for publication. Other trees under investigation are the Western yellow pine, the loblolly and short-leaf pines, the more important Southern hardwoods, the Adirondack balsam, and the second-growth hard woods of New England. The location, size, and ownership of the Big Tree groves in the California sierras have been thoroughly studied for the first time, and much fresh information has been obtained of the character of the tree.

"The region containing the proposed Appalachian Forest Reserve was examined in co-operation with the United States Geological Survey. The forest on 9,600,000 acres was mapped, the lands were classified, and a careful study was made of the forests. The result of this examination will be embodied in a report dealing with the suitability of this region for the purpose of a national forest reserve, the cost of such a reserve to the Government, and the good which would result from its careful and conservative management.

"The creation of the proposed reserve is, in my judgment, urgent, in order to protect the headwaters of important streams, to maintain an already greatly impaired supply of timber, and to provide a national recreation ground which, with the single exception of the Adirondacks, will be readily accessible to a larger number of people than any other forest region in the United States. I believe that these considerations render the purchase by the Federal Government of the proposed reserve in the Southern Appalachians desirable in every way. The policy involved is not new. The proposed purchase will not involve the creation of a precedent, for that has already been done. In 1896 the Government purchased from the Blackfeet Indians of Montana an area of approximately 615,500 acres for the sum of $1,500,000, and on February 22nd, 1897, it became part of the Flathead Forest Reserve.

"A study of the Sierra Forest Reserve has been undertaken, also in co-operation with the United States Geological Survey, and will shortly be completed.

"Following the requests of the Secretary of the Interior for reports on technical forest matters, the effect of grazing and of forest fires was investigated in twelve of the forest reserves. A study of the present forest condition of Nebraska and of the causes which led up to it was begun and pushed far towards completion.

Appendix XXVIII.

"The Bureau is now conducting an investigation in the South to devise conservative and practicable methods for improved turpentine orcharding. Since the maintenance of the naval stores industry is of urgent necessity in the Southern States, this investigation is one of the most important now being carried on by the Bureau.

"*Forest Exhibits.*—The forest exhibit of this Department at the Pan-American Exposition was superior in size and quality to that at the Paris Exhibition, which was awarded a gold medal. It included the largest coloured transparencies ever made.

"*Tree Planting.*—One of the most important and promising lines of work of the Bureau of Forestry is its study of economic tree planting and its co-operation with farmers and others in making forest plantations. Tree planting has so vital and intimate a relation to the welfare of the farmer in the treeless regions, that whatever assists him to grow trees assists him also in the production of every other crop. 46,145 acres were examined for planting during the year, and planting plans were prepared for 5,785 acres, while 148 applications for tree-planting plans have been received. The number of applications for commercial plantations of large size is increasing so rapidly that the usefulness of the practical assistance and advice offered to the tree planters will be limited only by the men and money available for the work.

"A series of important measurements of the growth of planted groves in the treeless plains has been begun in order to show the value of plantations as business investments. A careful study has been pushed during the year of the encroachment of forests on the Western plains in order to determine the possibility of reclaiming portions of non-agricultural Government land by planting forests."

Schools of Forestry.—There are three schools of forestry in the United States:—

(a) New York State College of Forestry, at Cornell University, Ithaca. Four years' course; practical instruction afforded by a demonstration area of 30,000 acres of State forest (*see* Appendix XXIX.).

(b) Yale Forest School, New Haven. A two years' graduate course. In connection with the Yale Forest School a two months' summer course is conducted at Milford, Pa. (*see* Appendix XXIX.).

(c) Baltimore School of Forestry, Baltimore. One year course, comprising practical work in the forest, theoretical instruction and forest research. No botany or other auxiliary sciences.

State Departments.—Sixteen States have official departments or offices for forest work.

Forest Reserves.—As appears from the foregoing report, considerable demands are made upon the Department of Agriculture in connection with the management of the Federal Forest Reserves. These Government reserves are administered by the Department of the Interior, but so closely is the subject of the reafforestation of these reserves related to the work of the Bureau of Forestry that the suggestion has been made by the Secretary of the Interior that it might be found advisable to transfer the supervision of all public forests to the Secretary of Agriculture. The following information (relating only to Federal forests, and exclusive of lands reserved by individual States) is taken from the Reports for 1900 and 1901 of the Secretary of the Interior.

The year 1817 was marked by the first enactment setting apart public lands for the purpose of drawing timber supplies therefrom. This Act empowered the Secretary of the Navy to cause such vacant and unappropriated lands as produce the live oak and red cedar timbers to be explored, and selection to be made of such tracts or portions thereof as might be necessary to furnish for the Navy a sufficient supply of said timbers. Three tracts were to be reserved from any future sale of public lands, and appropriated for the sole purpose of supplying timber for the Navy. Further Acts embodying the same principle were also passed between 1822 and 1831, after which date no further action in the direction of establishing a forest policy was taken for many years.

The agitation in favour of an administration of the forests on the public domain may be said to have begun in 1871 with the introduction of the first comprehensive forestry Bill in Congress. The Bill did not pass, but the movement received a strong impetus in the Department of the Interior, vigorous representations being made more particularly in 1877, which again resulted in the introduction of a Bill, likewise abortive.

It was not until 1891 that a brief clause in the Act of March 3 of that year definitely authorised the establishment of forest reservations, and the first important step was gained. The mere establishment of reservations, however, proved largely ineffectual, in the absence of provision for their administration. The embarrassment resulting from delay on the part of Congress led to the National Academy of Sciences being requested in 1896 to investigate and report upon the subject of a national forest policy for the forest lands of the United States. Following the report of the Academy's Forest Committee, Congress took immediate action by passing the Act of June 4, 1897, under which forest reservations are at present administered.

Generally speaking, the principle is to reserve only vacant lands, although, as has been mentioned above, it is in contemplation to purchase an area of nearly 10,000,000 acres in the Appalachian Mountains, with a view to arresting the rapid denudation going on there, and a "Presidential Message" recommending the purchase has been presented to Congress. The existing State reserves are being surveyed, and working plans prepared, as rapidly as circumstances permit. Grazing is permitted with the approval of the Secretary of the Interior, and in 1901 1,400,000 sheep were allowed on eight reserves, and 434,750 cattle and horses on 27 reserves. One of the most important duties is the prevention of fires. In the year 1900-01 311 fires (that passed beyond the incipient stage) burned 124,423 acres, as compared with 209 fires over an area of 158,577 acres in the preceding year.

The creation of forest reserves commenced immediately after the passage of the Act of 1891, and up to 1893 seventeen reserves had been established, embracing about 18,000,000 acres. After 1897 several other areas were reserved, and the total given in 1901 is 41, covering an estimated area of 46,410,000 acres. The first to be established was the Yellowstone Park Timber Reserve, proclaimed on March 30, 1891. The great majority of the reserves are in the mountainous regions of the West, particularly in California, Washington, Wyoming, Colorado, etc. The largest are: Cascade Range, Oregon (4,588,800 acres); Bitter Root, Idaho and Montana (4,147,200 acres); Sierra, California (4,096,000 acres); Washington, in the State of that name (3,426,400 acres); Lewis and Clarke, Montana (2,926,000 acres); Gila River, New Mexico (2,327,000 acres; and Mount Rainier, Washington (2,027,500 acres).

APPENDIX No. XXIX.

Appendix XXIX.

INSTRUCTION IN FORESTRY AT CORNELL AND YALE UNIVERSITIES.

(i) THE NEW YORK STATE COLLEGE OF FORESTRY (CORNELL UNIVERSITY).

(Abridged from the College Prospectus for 1900-01, the Annual Report of the Director for 1901, and the Testimony of B. E. Fernow before the United States Industrial Commission.)

Foundation.—The New York State College of Forestry was established by an Act of the State Legislature in April, 1898, authorising the trustees of Cornell University to create a department in the University for the purpose of education and instruction in the principles and practices of scientific forestry. The State of New York had, by various Acts, declared for a policy of forest preservation, with a view of protecting the watershed of the Adirondacks. In 1885 the State possessed a property of some 600,000 acres of timber, acquired by tax sales, mostly culled and more or less maltreated, and a Forest Commission was instituted for its management. To pave the way for the introduction of technical forest management on this area, a demonstration was proposed on a small scale, which was to show how a forester would manage a forest property, harvesting and reproducing the wood crop. In order to remove this demonstration, which would naturally require a considerable time, from the danger of political vicissitudes, its management was referred to Cornell University, and the College of Forestry was instituted as the agency to carry out the experiment, and at the same time to educate the foresters who would, in the future, manage the State's forest property. The same Act accordingly made provision for a demonstration forest of 30,000 acres in the Adirondacks. This tract has been located in Franklin County, near Tupper Lake, with Axton as headquarters. The area reverts to the State after 30 years.

While a State institution, the College is administered by the University, and its students profit by courses of study in the University classes and laboratories.

A sum of £6,250 was appropriated by the State of New York to start the forest area, and an equal sum was also provided to serve as working capital. For the College a separate annual appropriation of £2,083 has been made.

Staff.—The Faculty consists of the President of Cornell University, of Mr. B. E. Fernow (the Director of the College and Professor of Forestry), and of two Assistant Professors of Forestry. There are, besides, two Special Lecturers, a Forest Manager, and a Superintendent. Instruction in the fundamental and supplementary branches is given to forestry students by 38 professors and instructors of Cornell University.

College Forest.—The College Forest is managed to fulfil in the broadest sense the functions expressed in the Act creating it, namely, to "conduct upon such land such experiments in forestry as it may deem most advantageous to the interests of the State, and the advancement of the science of forestry, and may plant, raise, cut, and sell timber at such times, of such species and quantities, and in such manner as it may deem best, with a view to obtaining and imparting knowledge concerning the scientific management and use of forests, their regulation and administration, the production, harvesting, and reproduction of wood crops, and earning a revenue therefrom." The College Forest is also used for the practical instruction of students. To this end the third and fourth year students are transferred to Axton in the spring, and during the summer vacation opportunity is given to would-be students to become acquainted with forestry work in the College Forest.

The College tract is typical of the Adirondack woods, a hardwood forest composed of sugar maple, yellow birch, and beech, mixed with spruce and hemlock, and in some parts white pine, besides some other species occurring sporadically. Most of the area has been culled by lumbermen of the merchantable pine, which is nearly extirpated, and of the spruce, which has been considerably reduced. It is, therefore, the leavings of the lumbermen, a forest culled of its most valuable materials, which has been set aside for this experiment. There are, besides, the usual balsam and cedar swamps and considerable areas of burnt lands, grown up to aspen and white birch, where formerly the white pine was the dominant tree.

The sylvicultural policy is, briefly stated, to replace the old decrepit natural forest by a new and more valuable forest more or less rapidly. The financial policy is to bring about this change in the conditions of the property, as far as possible, by using only the profits which come from the harvest of the old crop. The first step necessary was, therefore, to find a market, which did not exist locally, for the hardwood. Since the hardwoods do not float, railroad construction is absolutely necessary for transporting the harvest out of the woods. This means that a comprehensive plan for the entire harvest is necessary. Consequently a contract was made with the Brooklyn Cooperage Company to erect stave mills, wood alcohol plants, and a railroad, for the purpose of taking the entire hardwood crop, logs and cordwood, that might be cut for the next 15 or 20 years.

Planting is done only with conifers, since the hardwoods are able to reproduce themselves readily without assistance, furnishing a sufficient amount of this desirable admixture. Large nurseries, in which material is grown from seed, to be transplanted to the woods when two or three years old, have been established. In these mainly white pine and spruce, together with other coniferous species, are grown, more than a million seedlings being now on hand.

The college forest is managed primarily as a business forest; but about 255 acres have been planted in varying manner for experimental purposes.

Admission.—For entrance into the College of Forestry for the full course leading to the degree of "Bachelor of Science of Forestry" (a title since altered to "Forest Engineer") there are required a primary and an advanced examination; but certain school certificates are accepted as exempting candidates from all or part of these. The subjects of these examinations are English, history, plane geometry, algebra, advanced German, advanced French (or Latin), and advanced mathematics. Candidates must be at least 18 years of age.

Admission to the short and synoptical courses is free to all students who furnish evidence to the director that they are able to pursue the work satisfactorily.

Courses.—The regular course leading to the degree lasts four years; and is intended to prepare men fully to take charge of forest estates, private or State, to advise in administration of such estates, and prepare working plans, to take charge of land and timber departments, and finally to teach the science of forestry in the colleges which are likely in the near future to provide separate chairs for forestry science and practice. The first two years of this course are mainly devoted to the study of preparatory subjects, natural sciences, mathematics, engineering, political economy, etc., and the last two years to forestry proper.

To meet the requirements of students of political economy and others who desire a survey of the subject of forestry as a matter of general education, a synoptical or introductory course of two hours a week is given during the second term.

A one-term course is arranged for special students, farmers, lumbermen, young men who cannot spend four years in preparing themselves to become foresters, and who yet wish to avail themselves of technical and practical instruction in forestry that might enable them to manage their own woodlands more intelligently. This course occupies five hours per week during the first term.

The regular course is so arranged that students who can spend only three years at the college will, at the end of that time, have acquired full preparation in the fundamental sciences and in all the forestry branches essential for the successful management of woods, for which working plans have been prepared, the making

Appendix XXIX.

of working plans being deferred until the spring term in the fourth year. To students who have satisfactorily proved their efficiency in this three-year-course, the designation of "Forester" will be given.

Opportunity is also provided for sufficiently advanced students to take up such work as they may be qualified for.

Field Work.—In addition to short excursions to neighbouring woods, to milling and wood manufacturing establishments, etc., during the fall and winter terms of the third and fourth year, these classes will spend the entire spring term after Easter in the college forest at Axton. This term is devoted mainly to practice and field work. This includes

(*a*) Exploitation and Surveying.—Inspection of lumber camps, logging operations, transformation methods, and mills; laying out and constructing roads, dividing and marking forest areas.

(*b*) Sylviculture.—Inspection of and participation in planting, sowing and nursery work, making improvement cuttings, and marking out for thinning and natural reproduction.

(*c*) Mensuration and Valuation.—Tree measurement and studies of the rate of growth, timber estimating.

(*d*) Forest description and regulation.—Gathering data for working plans, and elaboration of such plans for given areas.

Schedule of Courses.—The following table shows the number of lectures per week given in each subject. Courses in parenthesis are either substitutes or elective in whole or in part. The selection must be made at the beginning of the year, with the previous written approval of the director.

—	FIRST YEAR.		SECOND YEAR.	
	1st Term.	2nd Term.	1st Term.	2nd Term.
Solid Geom., Adv. Algebra, plane and sph. Trigonometry.	2	2	—	—
Analytical Geom. and Calculus	(3)	(3)	—	—
Physics	2	2	—	—
„	(5)	(5)	—	—
Chemistry	3	3	4	—
„	(4)	—	(6)	(6)
Invertebrate Zoology	2	3	—	—
Botany	3	3	—	—
Land Surveying	—	4	—	(2)
Meteorology (Geology)	2	—	—	—
Forestry	—	2	(5)	3
Entomology	—	—	(3)	(2)
Vertebrate Zoology	—	—	3	3
Dendrology (Botany)	—	—	3	—
Geographical Botany	—	—	—	1
General Geology	—	—	3	3
Soils (Geology)	—	—	2	—
Pen Topography	—	—	—	2
Political Economy	—	—	3	3

	THIRD YEAR.			FOURTH YEAR.		
	1st Term.	2nd Term		1st Term.	2nd Term	
		At College.	At Axton.		At College.	At Axton.
Botany	3	3	—	—	—	—
Physical Geography (Geology)	(3)	(3)	—	—	—	—
Fish Culture and Game Preservation	—	—	2	—	—	—
Forestry	4	—	5	4	4	—
„	—	2	2	4	2	10
„	—	2	5	2	2	2
„	3	—	3	2	—	—
Political Economy	—	—	—	(2)	(2)	—
Seminary	—	—	—	2	2	2

The various courses in forestry comprised in the foregoing schedule are as follows:—First year: (1) Synoptical course in forestry. Second year: (2) One term course in forestry, with special reference to sylviculture; (3) biological dendrology. Third year: (4) Sylviculture; (5) forest protection; (6) exploitation; (7) forest mensuration; with practicum in sylviculture, forest mensuration, and exploitation and surveying. Fourth year: (8) Timber physics and wood technology; (9) forest regulation; (10) forest valuation and finance; (11) forest administration; (12) forest history and politics; with practicum in forest regulation (making working plans).

Special courses of lectures on various subjects are also provided.

Fees and Expenses.—Tuition is free to students who are residents of the State of New York. To others the annual tuition fee is $100 (about £21), half to be paid at the beginning of each half year. As the first two years are mainly taken up with fundamental courses furnished by the university faculty, the tuition fees for these two years go to the University; during the last two years they go to the College. Special students pay £13 each half-year. Laboratory materials are charged for at cost, and security must be deposited by every person taking laboratory work. In addition to living expenses, which may vary from about £1 to £2 10s. per week, the student should be prepared to meet the expenses for inspection tours, and excursions in the third and fourth years, which may require from £2 to £20 in a year. Expenses in the college forest, including board, lodging, and laundry, may be kept within £1 5s. a week.

Number of Students.—At the beginning of the year 1901-2 the number of students amounted to 35, comprising 3 fourth year, 5 third year, 9 second year, and 13 first year students, besides 5 special students.

Finances.—The expenses of the College are defrayed out of the annual grant of £2,083 from the State. The receipts and expenditure in respect of the College Forest are kept entirely separate, and are shown in the following statement for the eighteen months ended 31st December, 1901. The appropriation of £6,250 is to be treated as working capital, to be kept intact and replenished by the sale of log and wood harvest.

RECEIPTS.	£.	EXPENDITURE.	£.
Appropriation	6,250	Maintenance	1,002
Rents	97	Improvements (nurseries, planting, road work, &c.)	1,013
Students' fees	237	Building	144
Wood sales	837	Equipment	55
Work on roads	224	Survey	117
Sundry receipts	462	Logging	10,403
Logging contract, part payment	5,729	Balance unexpended	1,102
	£. 13,836		£. 13,836

There are now to the credit of the logging account, awaiting delivery and payment, about 2,500,000 feet of hardwood logs, 500,000 feet of spruce logs, and an unmeasured quantity of cordwood, besides other wood materials. Expenditures for permanent investment in railroad, roads, nurseries, buildings, equipment, represented in the above account may be valued at £2,500, not including the value of plantations.

(II.) THE YALE FOREST SCHOOL.

(Abridged from the Prospectus of 1901-2.)

The Yale Forest School was founded in the spring of 1900 by the gift of $150,000 (about £31,250) from Mr. and Mrs. J. W. Pinchot and their sons. The gift provides for the establishment of a department in the University, to be known as the Yale Forest School, for instruction and research in forestry. The gift also provides for a summer school of forestry at Milford, Pike County, Pennsylvania, on the estate of Mr. Pinchot, who has placed a building and his woodland at the disposal of the Forest School for twenty-one years.

Equipment.—The school building is equipped with lecture rooms, a library, botanical and wood-testing laboratories, herbarium, and forest museum. The library contains over 1,500 books, and is being enlarged as rapidly as the funds permit. The herbarium consists of more than 2,000 specimens of native and foreign trees and shrubs, and much further material has been promised. The forest museum contains collections of wood specimens representing all the species of trees in the United States and Canada, besides other American and Philippine woods. A large collection of saws has been mounted, and a complete set of axes and logging tools will soon be set up. The botanical laboratory is thoroughly equipped with microscopes and other apparatus for research work in botany. The wood-testing laboratory, now being equipped, will contain testing machinery and other apparatus required in the study of the physical and mechanical properties of wood.

The Yale Botanical Garden, covering ten acres, is used by the students of the school in botanical work, and for experiments in tree-planting; and the use of botanical, mineralogical and zoological collections is extended to the forest school.

Field Work.—The field work during the first year and the first half of the second year is conducted in the forests near New Haven. The most important tract devoted to this purpose is Maltby Park, an area of about 400 acres, the use of which has been granted to the school by the New Haven Water Company. The courses have been so arranged that the entire spring term of the second year is spent in the field. The tract at Milford, Pennsylvania, mentioned above, will also be used for the practical field work of the graduating class during a portion of the spring term. The land is admirably adapted to instruction in forestry, as it represents the average conditions in the eastern hardwood forests. Large tracts in the Adirondacks and White Mountains have been offered to the school for practical forest instruction, by Mr. Rockefeller and the International Paper Co., and the owners have expressed their willingness to provide camps for the accommodation of the students.

Staff.—The teaching staff consists of the director, Mr. H. S. Graves, who is also Pinchot Professor of Forestry; Mr. W. H. Brewer, Professor of Agriculture; and Mr. G. Pinchot, Special Lecturer in Forest Policy; with thirteen "additional instructors."

Degree.—Graduates of the Forest School who have previously received Bachelor's degrees from collegiate institutions of high standing, or who have had an equivalent training, will be granted the degree of Master of Forestry.

Special Students.—Under exceptional circumstances students who are not candidates for a degree, but who can show their fitness to pursue the courses given in the forest school, are admitted without examination. It is, however, the policy to encourage students to take the full course. Those students who wish to take a short course in forestry, and are unable to pass the entrance examinations to the Yale Forest School, are advised to avail themselves of the privileges offered by the summer school at Milford, which is intended to meet their special requirements.

Fees and Expenses.—The annual charge for tuition is $100 (about £21). Laboratory fees of $5 (about £1 0s. 10d.) are charged for each of the courses in mineralogy and morphology of plants. Board and lodgings can be obtained in New Haven at prices ranging from £1 per week upwards. Frequent excursions are taken to points of interest near New Haven, but involve an annual expense of little more than £5. In the spring of the second year the work is transferred from New Haven to the field. The travelling expenses then incurred are about £12 10s., exclusive of subsistence, reckoned at about £1 a week. The graduation fee is $5.

Admission.—Candidates for admission must be not less than 20 years of age, and must produce certificates of good moral character. Graduates of colleges or scientific schools of high standing, who show the requisite knowledge of botany, geology, and inorganic chemistry, are admitted without examination. Other candidates must pass entrance examinations in the following subjects:—Algebra, plane geometry, solid and spherical geometry, trigonometry and the use of logarithms, botany, geology, chemistry, physics, German or French, English, and political economy.

Curriculum.—The regular course covers a period of two years. The subjects have been so arranged that nearly all the preliminary work is completed in the first year. Enough technical forestry is, however, taught in the first year to enable the students to make sylvicultural studies, to investigate the growth and reproduction of trees and forests, to establish forest plantations, and to make thinnings and other classes of cuttings. The second year is devoted to advanced technical work in the class-room and in the field.

Courses of Instruction.—The following are the lectures in the two years' course, the figures in brackets indicating the number of hours occupied by the lectures:—

First Year, First Term.—Introduction to Forestry (3), Sylviculture (3, and field work), Forest Measurements (2, and field work), General Morphology of Plants (laboratory work and informal lectures, 4), Forest Botany (lectures and laboratory work, 2 to 4, and excursions), Mineralogy (laboratory work, 4 hours), Zoology (2).

Second Term [First Half].—Sylviculture (3), Forest Measurements (2, and field work), General Morphology of Plants (laboratory work and informal lectures, 4), Appendix XXIX.

Forest Botany (lectures and laboratory work, 2-4, and excursions), Elementary Petrology (1), Zoology (1), Meteorology and Forest Physiography (4), State and National Forestry (4 to 6 special lectures), Forest Hydrography (4 to 6 special lectures). [Second Half.]—Sylviculture (3, and field work), General Morphology of Plants (laboratory and informal lectures, 4), Forest Botany (lectures and laboratory work, 2-4, and excursions), Origin and Nature of Soils (1), Zoology (1), Surveying and Field Engineering (field and class-room work, 4-8).

Second Year, First Term.—Forest Management (4, and field work), Forest Technology (lectures and laboratory work, 2-4), Lumbering (2), Forest Protection (1), History of Forestry (1), Diseases of Trees (2).

Second Term [First Half].—Forest management (4, and field work), Forest Technology (lectures and laboratory work, 2-4), Lumbering (2), Forest Protection (1), Forest Entomology (2), History of Forestry (1), Forest Administration and Law (1), Forest Roads and Trails (1). [Second Half].—Field work in Pennsylvania, in the Adirondacks, and in the White Mountains.

Summer School of Forestry.—This is located at Milford, Pa. The purpose of the summer school is to provide instruction for those who do not wish to take, or who are not ready for, the more advanced technical courses at regular forest schools. The course is designed for:—

(1) Owners of woodland (farmers, lumbermen, and others who wish to obtain a knowledge of the principles of forestry and a practical acquaintance with the care of woodlands, and with tree planting, will receive instruction to meet their special requirements); (2) forest rangers, the course being particularly adapted to those who wish to fit themselves for work as such; (3) teachers (instruction in forestry is now given in a considerable number of agricultural colleges, industrial schools, and other institutions, both in connection with the study of horticulture and as separate courses, and it would, doubtless, form part of the instruction in botany and nature study in public and private schools, if the teachers were properly qualified); (4) students of forestry who are deficient in certain subjects; and (5) all persons who desire to acquire a general knowledge of forestry, or any of its branches. Opportunity is also provided for advanced students to carry on special forest work.

The summer school of forestry is equipped with a school-building, containing a large hall and three smaller rooms, two of which will be used as laboratories, and the other as a library and reading-room. For practical instruction in the field Mr. Pinchot has given a tract of about 60 acres of woodland, and also considerable open ground for tree planting. One of the Pennsylvania State Forest Reservations is but a short distance from Milford, and will be available for study, as will also other forests in the immediate neighbourhood. Tents will be furnished by the school for those who desire to live in camp.

There is no entrance examination, but candidates must be at least 17 years of age. The school is open to women. The term commences, in 1902, on July 1st, and continues eight weeks. The fee for a single session is $25 (about £5 4s.). Five regular courses are offered; students may take any or all. They are: Forest Botany, Sylviculture, Forest Measurements, Introduction to Forestry, and Forest Protection. Practical work in the woods will form an important part of the instruction.

Number of Students.—The list of students in attendance at the Yale Forest School in 1901-2 comprised 10 second year and 21 first year students; and the number in attendance at the summer school in 1901 was 27.

INDEX TO EVIDENCE.

Aberdeenshire County Council Lectures.—Bailey, 335, 387–9; Somerville, 2990–2, 3099–113.

Abies Nobilis.—Ramsden, 612–4.

Afforestation: (a) *Areas available for.*—Margerison, 268–70; Bailey, 335, 350–6, 364–5, 491–4, 498–9; Selborne, 511–3, 587–8; Slater, 750–4; Havelock, 981; Forbes, 1366–9; Robertson, 1594–5, 1686–8, 1745–8, 1872–8; Davidson, 2063–5; Vernon, 2087, 2217–25; Schlich, 2267–70, 2293–4, 2299–307, 2358–61, 2451; Drummond, 2477, 2569–70, 2578, 2584–5; Somerville, 3002, 3063; Webster, 3225–6, 3233, 3237–40; Michie, 3475–7; Ward, 3509; Parry, 3689–90; App. I., II. (ix., xi.), III., X., XXII.

(b) *Compulsory re-planting.*—Margerison, 262; Drummond, 2588–9; App. III., XXVI.

(c) *Desirability of State afforestation.*—Bailey, 452–3, 504–5; Selborne, 587–8; Ramsden, 736; Slater, 811–4; Havelock, 982–8; Forbes, 1211–3; Glanusk, 1383; Robertson, 1866–71, 1896; Davidson, 1912–3; Vernon, 2110, 2217–9; Schlich, 2269, 2293–4, 2302–7, 2331–6, 2361–9; Drummond, 2487–8, 2569–70; Webster, 3188, 3197–9, 3207, 3225–9, 3239; Michie, 3480–1; App. II. (viii., xiii.), VIII.

(d) *In foreign countries.*—App. XXV., XXVI., XXVIII.

(e) *Would provide employment for labour.*—Margerison, 89–92; Bailey, 335; Robertson, 1612–4, 1814–25; Davidson, 1915, 2004–27; Vernon, 2220–1; Michie, 3421–37, 3471–4; Parry, 3643, 3664, 3692–4.

Agricultural Rates Act.—Ramsden, 641–2, 692; Maxwell, 2850–62; App. XII., XIX.

Alice Holt Woods, Area under wood.—App. XXI.

Alsace Lorraine, Area and finances of State forests.—App. XXVII.

Altitude up to which trees can be profitably grown.—Bailey, 495–7; Ramsden, 718; Glanusk, 1384–9, 1464–74; Davidson, 1916–21; Schlich, 2273, 2328; Drummond, 2571–2; Webster, 3218–31, 3250–3; Michie, 3400–3; Parry, 3698–700.

Arboricultural Society, English.—Slater, 821; Davidson, 1897–901, 1935–53, 2058–9; Somerville, 2987, 3060–1.

Evidence on behalf of.—Davidson, 1897–2072.

——————— Royal Scottish.—Slater, 821–5; Robertson, 1662, 1673–7, 1855–8; Somerville, 3060–1; App. II. (iii., iv., vi., vii.).

Evidence on behalf of.—Robertson, 1581–896.

Area: (a) *under woods in Britain.*—Craigie, 2904–8, 2929–32, 2954–66, App. XIV., XXI.

(b) *Of State woods in France and Germany.*—App. XXVII.

Argentina, timber supplies.—Schlich, 2262, App. II. (xi.).

Ash: (a) *Increasing scarcity.*—Margerison, 49–54, Hopton, 330.

(b) *Prices.*—Havelock, 1049–50, App. VI., App. IX., App. X.

(c) *Profitableness.*—Margerison, 81, 164–70, 271–91; Havelock, 1092–3; Vernon, 2106; Schlich, 2432.

(d) *Quality.*—Margerison, 247–50; Hopton, 325–7, 329; Croxford, 2731; App. III.

Australia, timber supplies.—App. II. (xi.).

Austria.—Bailey, 423; Schlich, 2259, App. II. v., xi.), XXV, XXVI.

Austrian Pine for shelter belts.—Bailey, 399–402, App. I.

Bailey, Lieut.-Col. F. (Analysis of his Evidence).—Has been Director of the Forest School in India, and in charge of the English students at Nancy; is lecturer on forestry at Edinburgh University and editor of the Royal Scottish Arboricultural Society's Transactions, 332–4. Woods in Scotland are insufficiently stocked, principally owing to over-thinning, and the sylvicultural methods commonly practised do not result in the production of a remunerative class of timber, 335. Woods are chiefly grown for game preserves or for amenity, 335. Owing to irregular working the regular supplies of suitable material cannot be ensured in this country; all profit-earning woods should be managed under a settled plan, plan, in the absence of which both money and time are wasted, 335. Financial results are not satisfactory, but the results hitherto obtained from improperly-managed woods are no guide to what could be done with good management, 335, 366. Our climate is very suitable for growing trees, 335, 393. We have no forests which have been managed so as to show the results of correct working, 335. Two or three model State forests are urgently required to serve as examples and for the conduct of experiments, 335, 339, 382–6, 470–1, 502–7. A course of lectures on forestry has been given for the past 12 years at Edinburgh University, the total attendance in the past ten years being 76, 335. During 1901–2 there were 91 class-room lectures and 18 hours work in the field, 335. A forest garden in the immediate vicinity of Edinburgh is also wanted, 335, 383–6, 418–9, 507. Witness has given lectures on forestry for the Aberdeen County Council, 335, 387–9. Large areas of waste land in Scotland might profitably be planted, 335, 350–6, 364–5, 491–4. Every 1,000 acres of added forest would provide work for about 15 men, 335. The supplies of timber from abroad are becoming exhausted, 335, 371–2, 409–14. There is a general desire for instruction among foresters in Scotland, 336–8. If there were to be only one State forest, Edinburgh would be a suitable centre, 339–42. A separate forest school would require a large staff, whereas at a university it would be much simpler to provide instruction in forestry; we should begin by organising instruction in forestry at a university, 342–3. It is desirable to have more than one State forest, on different classes of land, 344. A forest garden is wanted at each centre of instruction, besides a model forest which might serve several centres, 343–8, 382–6. The landowner and agent require education in the first instance, before the forester, 349. A small commission should be appointed to ascertain what land might be afforested, 354–6. A model forest is wanted in which to take the students to show them how trees properly managed are growing, 357, 470–1. The want of this is seriously felt in Edinburgh, 357. Instruction is necessary for the development of colonial as well as a home forestry, 358. We should start by concentrating our efforts upon a single centre, 359. The Government should buy an estate in Scotland, and affiliate it to Edinburgh University, 360. The model forests should be under the Board of Agriculture, 361. The size should be 1,500 to 2,000 acres, costing not more than £40,000, 362. The revenue would at first be small, but it should, when in order, yield not less than £1,000 per annum, 363. Forestry is an optional subject for the degree of B.Sc. at Edinburgh, 367. The students attending witness's lectures are probably men looking out for factorships, or who are going to farm, and eldest sons of proprietors, 367; not many foresters, 461–2. In 1891–2 no fees were charged and the attendance was about forty, 335, 368–70. The quality of imported timber is falling off, and some of it is now railway borne 335, 371, 437–45. The uses of timber are increasing, 372. Large areas of forest in America have been burnt to make clearings, 372. More precautions should be taken against fires in this country, by apparatus on engines and by owners planting suitable belts near the railways, 373. Suitable well-rooted trees should be grown on the outsides of forests to minimise damage by wind, 373. Woods managed on the continental system are not more unsightly than others, 374–8. Land is often left bare after felling for a few years probably to get rid of the weevil, but there is great loss under this system 379. Vacancies due to the death of young trees during the first few years ought also to be filled up, 379–81. County Council lectures once a week at a centre during the winter might be of advantage, 390–2. Natural regeneration of Scots pine and larch is very successful in Strathspey, 393–5. A railway company was unable to place an order in Scotland for 100,000 sleepers of Scots pine, 335, 396–8. Mountain pine, Austrian pine, Corsican pine, and silver fir are often good shelter trees to plant outside the woods, 399–402. There is no scarcity of labour in Scotch forests, 404 ; agricultural wages in Scotland are higher than in England, 405. Death duties are a difficulty in the way of planting, 406–7. We have to look to temperate countries as the main source of our supplies, 408–14. We must have model forests as the only way of exciting interest in planting among owners and trustees, 414–7. The forest garden would only be used for the study of forest botany and as a sort of nursery, 418. The model forest should be more or less under wood to start with, 419–20. It would be a good thing to interest landed proprietors so that they should allow their woods to be used for instruction, 419–24. Co-operation among landowners to form a forest school, as in Austria, is not probable in this country, 423. A higher class of instruction should be given at Edinburgh, while instruction should be given by a competent manager in the model forest to the working foresters, 425–32. Forestry ought to have a much more prominent position at Edinburgh, so as to give a complete education in forestry, not only for this country, but also the colonies, 433–6, 482. Witness has given evening lectures at the Heriot-Watt College, 433. Imported timber from the Baltic and Canada is falling off in quality, 437–40. The deterioration in quality shows that the supplies are becoming exhausted, 441–2. The manufacture of paper from wood-pulp is an important factor in diminishing stocks of timber, 443–4. Not much replanting is being done in America, 445–8. The State model forest should not be less than 1,000 acres, 450–1. The State should acquire waste land for afforestation, 452–3. In Hungary the State possesses a large forest area, and has a good school, 454–7. The increased revenue from Indian forests is due to better working of the forests, 459–60. The salary of foresters is not sufficient to justify their attending university courses, 461–7. When proprietors realise the value of their forests, the salaries of foresters would increase, 467. At first the foresters should be trained in the model forest, and there should be class-rooms in the forest, 467–71. Itinerant advisers in forestry would be of some use, but would not meet the case, 472–6. Large woods are a very valuable property, and to manage them properly require a man who has been highly trained, 477–9. It will be some time before we get fully trained men, and planting must be done before that, 479–81. Many old woods in Scotland carry only a light stock of timber, 482*–5. Students must carry on outdoor work concurrently with instruction by lectures, 486–90, 494. Some land in Great Britain is at too great an altitude to be planted, 495–7. The existing area under wood in this country could be more than trebled, 498–9. Peat land is suitable for planting, 500–1. Private enterprise will not cover all the land available for timber, 504 ; if the State makes a start others will follow, 505. A site should be chosen for the model forest so as to show the greatest possible number of demonstrations, 506.

(*Recalled.* 6th May.)—A regular working plan, with account and control books showing the receipts and expenditure, and that the provisions of the working plan are being properly carried out, is indispensable to profitable management, 2782–5, 2823–4. The working plan lays down what areas are to be felled every year for some twenty years ahead, and books should be kept to show whether this is done as prescribed, so that any deviation from the plan due to storms, etc., can be adjusted next year, 2786. The cash-book shows exactly the receipts and expenses for each wood, with a summary for the whole area, 2786. It is impossible to give instruction in forestry without an area for practical demonstration, 2787–8. This area must be properly managed to pay financially, 2788, 2792, 2796. Students cannot be taught sylviculture in a wood when sylviculture is not properly carried out, 2788, 2797–9. Such a forest should be 1,000 to 1,500 acres, near Edinburgh, with varied conditions of altitude, etc., 2789–90. The professor at Edinburgh should have control over the work of the forest, as on the continent, otherwise friction may arise, 2791. Witness cannot name any particular area, but one may be acquired, 2793–5. There are plenty of woods where students may see the result of bad work, 2798, 2802. There might have to be more than one area, if all varieties of soil, etc., could not be secured on one area, 2800–1. An area for experiment would be included in the instruction forest, 2803. The forest should be within easy reach of the college, 2804–6. Landowners and agents should be trained at the university, otherwise the cost of separate professors would be too high, but foresters in the forest, 2806–7. A demand for a spearate forest school might arise ultimately when owners pay their foresters at a higher rate, 2807. Very few accounts are kept, owing to lack of interest, 2808–10. There would be no difficulty in drawing up plans for existing woods, 2811–8. There is need to train men who could draw up working plans, 2819–20, 2827. It would be desirable that land acquired for a demonstration forest should have trees upon it to begin with, 2821–2, 2828–30. A well-conceived plan of forest book-keeping prevails in the forests of India, 2825–6.

Appendix II. :—(i.) Forestry in France ; (ii.) Forestry in Hungary ; (iii.) President's Address, Royal Scottish Arboricultural Society, 1899.

BADEN.—App. XXV., XXVI., XXVII.

BALFOUR, I. B.—President's Addresses, 1891 and 1892, to the Royal Scottish Arboricultural Society, App. II. (vi., vii.). Forestry, in Britain, Address to British Association, 1894, App. II. (viii.).

BALTIC timber.—Bailey, 437–40 ; Schlich, 2259 ; Croxford, 2760–5 ; Michie, 3438, 3452 ; Roberts, 3735–9, 3743–8 ; App. II. (xi.), XVIII.

BARRES : (*a*) *Forestry School.*—App. II. (i.).
(*b*) *Seed-control station.*—App. XXV.

BAVARIA : (*a*) *Area and finances of State forests.*—App. XXVII.
(*b*) *Legislation regarding woodlands.*—App. XXV. XXVI.
(*c*) *Programme and regulations of Lower forestry schools.*—App. XXIV.

BEECH : (*a*) *Growth of in Bucks.*—Ramsden, 656–62 ; Vernon, 2073–256 ; App. IX.
(*b*) *Importation.*—Hopton, 318–21 ; Vernon, 2116–8, 2209–10.
(*c*) *Prices.*—App. VI., IX., X.
(*d*) *Quality of home and foreign.*—Margerison, 69–71, 93–105 ; Hopton, 322 ; Vernon, 2242 ; Croxford, 2731–2 ; App. III..

BELGIUM, importation of timber from.—Hopton, 312–21.

BIRCH : (*a*) *Imported for the chair industry.*—Vernon, 2206.
(*b*) *Prices.*—App. VI., IX., X.

BIRDS.—Margerison, 296–9 ; Selborne, 549–50 ; Somerville, 3132.

BIRMINGHAM Corporation waterworks.—Glanusk, 1528–30.

BOARD OF AGRICULTURE : (*a*) *Evidence on behalf of.*—Craigie, 2887–986 ; App. XIII., XIV.
(*b*) *Powers with reference to loans for planting.*—Drummond, 2579–83 ; Craigie, 2887–903; 2915–28, 2933–42 ; App. XIII.
(*c*) *Publication of information.*—Forbes, 1183–5, 1235–47 ; Drummond, 2567–8 ; App. II. (viii.), VIII., X.

Board of Forestry, suggested.—App. I.

Bog or Peat Land.—Bailey, 500–1 ; Schlich, 2333–6; Webster, 3286–312.

Book-keeping, forest (see also *Working Plans*).—Havelock, 897, 924–8, 1098–1101; Drummond, 2485–6 ; Pitcaithley, 2631–2 ; Bailey, 2782–6, 2808–10, 2823–7.

Boppe, M., opinion on English woods.—Bailey, 357 ; App. I.

Botany, study of.—Schlich, 2441–3 ; Ward, 3532–5, 3553–71, 3583–605 ; App. II. (viii.), XVI.

Bounties for afforestation.—Drummond, 2506–App. X., XXV.

Brandis, Sir D.—The Proposed School of Forestry, App. II. (v.).

Bridges scheduled by local authorities.—Margerison, 234–8 ; Havelock, 1069–70.

Brandenburg Chamber of Agriculture, work of forest experts.—App, XXV.

Cambridge : (*a*) *As suitable centre for instruction.*—Schlich, 2274–86, 2353, 2439, 2445–7 : Drummond, 2457–8, 2550–4 : Somerville, 2998–3001, 3023–4, 3069–72 ; Ward, 3494–504, 3510–48 : App. XX.
  (*b*) *Evidence on behalf of University.*—Ward, 3492–641.
  (*c*) *Instruction provided at University.*—Somerville, 2994–7, 3018–22, 3057–9, 3070–4.

Canada : (*a*) *Importation from.*—Bailey, 437–42 ; Vernon, 2206–7 ; Schlich, 2258, 2262–4 ; Croxford, 2738, 2745–8, 2755, 2769–71 ; Michie, 3356 ; App. II. (xi., xiii.).
  (*b*) Timber supplies.—Schlich, 2262–4 ; App. II. (xi.).

Canals.—Margerison, 19.

Capercailzie, injury caused by.—App. I.

Carriage of Timber, see *Transport*, also *Railway Rates.*

Catchment areas, see *Waterworks.*

Cattle, injury caused by.—App. I.

Chair industry at Wycombe.—Vernon, 2113–22, 2206–10, 2227–8, 2249–50.

Chiltern Hills.—Vernon, 2073–2256 ; Schlich, 2277 ; App. IX.

China, timber supplies.—App. II. (xi.).

Cirencester Royal Agricultural College, instruction.—App. I.

Climate, suitability for growth of timber of English.—Margerison, 39–41 ; Bailey, 393–4 ; Robertson, 1665 ; Schlich, 2273, 2378–9 ; Pitcaithley, 2703 ; App. I., II. (ix.), III.

Colleges, see *Education* (*University and Agricultural Colleges*).

Collieries (see also *Pitwood*), plantation of spoil heaps.—Margerison, 87–8.

Colonies, demand for foresters.—Bailey, 358 ; Schlich, 2274 ; App. XX.

Committee, suggested appointment of.—Bailey, 354–6 ; Schlich, 2270, 2361, 2451 ; Somerville, 3064–5 ; App. VIII.

Conifers generally (see also *Pine, Larch, Spruce,* etc.) : (*a*) *Quality of British and foreign.*—Margerison, 13–14, 107–8 ; Roberts, 3735–9 ; App. III., XVIII.
  (*b*) *Relative advantages of conifers and hardwoods.*—Margerison, 164–5, 284–91.
  (*c*) *Supplies of coniferous timber.*—Margerison, 109–10 ; Schlich, 2259–65 ; Croxford, 2780–1 ; App. II. (xi.).

Continental system of sylviculture.—Margerison, 93–106, 239–43, ; Bailey, 374–8 ; Selborne, 591–2 ; Havelock, 978–9, 1034–7 ; Robertson, 1641–4, 1778–80 ; Davidson, 1947 ; Vernon, 2182 ; Schlich, 2271–3, 2392 ; Pitcaithley, 2700–2 ; Ward, 3497 ; App III., XI.

Control Books, see *Book-keeping.*

Co-operation : (*a*) *Among landowners to provide instruction.*—Bailey, 423 ; Forbes, 1308–11 ; Schlich, 2295 ; App II. (v.), XXV.
  (*b*) *Forest societies.*—App. II. (xiii.), XXV.

Coopers Hill.—Schlich, 2290–2 ; Somerville, 3075 ; Ward, 3511–3 ; App. I., II. (v.).

Coppice.—Selborne, 561 ; Ramsden, 678–86 ; Havelock, 929–32, 1113–6 ; Webster, 3274–80.

Cornell University, instruction in forestry.—App. XXIX.

Corsican Pine.—Bailey, 399–402 ; Selborne, 598–600 ; Drummond, 2494–7 ; Webster, 3258, 3300 ; App. I.

County Councils, Instruction and assistance given by—Bailey, 335, 387–92 ; Forbes, 1302–7, 1336–8 ; Somerville, 2990–7, 3005–22, 3049–59, 3076–8, 3099–122 ; 3133–6.

Craigie, Major P. G. (Analysis of his Evidence.)—Is Assistant-Secretary to the Board of Agriculture. The Board of Agriculture's policy as regards loans is stated by Mr. Elliott in the evidence before the Royal Commission on Agriculture, 2887–8. The original policy of the State was to make advances for the drainage of land, but the system has subsequently embraced other matters, 2888. The loans are very little taken advantage of for planting, 2889, 2898, 2933, 2937–8 ; because there is no immediate return to the owner, while there is an immediate charge for interest and redemption, 2889. Advancing money on other terms would be difficult, 2890–1. It is doubtful whether the timber could be legally mortgaged separately, and Mr. Forbes' scheme presents great administrative difficulties, 2892–6. A longer period might be allowed for the repayment of loans, which would lower the annual charge for redemption, 2897–8. In 1899 the period of repayment was extended from 25 to 40 years, 2899 : and loans already made for 25 years can be extended to 40 years, subject to the planting being inspected, 2899 ; no advantage has been taken of this last provision, 2936, 2940. Expenditure in connection with such loans on forestry would have to be very carefully supervised, 2900–3, 2941–2. Statistics of the area under woodlands are obtained at intervals, 2904. There is no official definition of woodland, 2905–2909. The apparent increased average of woodlands is probably due to greater exhaustiveness in the returns, 2906. The Ordnance Survey ascertains the area by a survey on the ground, 2907 ; they show different kinds of woods differently, but a summary of their data would be difficult and costly, while the particulars relate to varying dates, 2908, 2966. Grants in aid of agricultural education are only given when local support is also forthcoming, 2910–11. The State pays annually about £8,000 directly through the Board of Agriculture for agricultural education, 2912–3, 2967–9 ; but about ten times that amount is also devoted to the same purpose out of the sums provided by the Local Taxation (Customs and Excise) Act, 2912–3. No special grants are made for forestry education, but some of the institutions receiving grants teach forestry, 2914, 2969–74. A landowner wishing to borrow money from the State for planting applies to the Board of Agriculture, or one of the Land Improvement companies; the site is inspected by one of the Board's Inspectors, and, on the latter approving, a provisional order authorising the expenditure is issued; the work is again inspected on completion, and an absolute order issued creating the charge on the estate, 2915–9. The inspector roughly estimates the cost, 2917. The owner borrows the money from a land company, or may provide it himself, 2920. Landowners can, under the Settled Land Acts, use capital in the hands of trustees for planting, 2920. The period of the loan is determined by the Board of Agriculture, 2921–2; the loans being cleared off during that period, 2934–5. No supervision is exercised after the loan is sanctioned, 2923, 2941–2 Generally the companies, when they get the charge, sell it to an insurance company, 2923, 2940. The principle of the loans is that the estate should be benefited, 2924. A sufficient area of the estate is mortgaged to justify the charge, 2925. It is possible that the plantations thus formed may be neglected, 2926–7. The total sum spent on planting under the system in 50 years is less than £100,000, 2927. It would require a very large area of woodland to form security, but the woods may generally be kept up in some form and the loan is secured, although there might be neglect of the timber value, 2928. On the Ordnance Survey maps woodland is measured as wood when enclosed, 2929. Some of the land which has gone out of arable cultivation has been planted, 2930–2. There have been only nine applications for planting since the Act of 1899, 2933, 2937. The land companies know that the loans can be obtained for planting, 2939. Plantations improve the value of an estate beyond the actual value of the wood, 2924, 2943–4. Gorse land is probably not included in woodland, 2945–7. Land may be planted for fox coverts or for sport, 2947–53. The Board of Agriculture's returns of woodland are independent of the Ordnance Survey, 2954–5, 2962; although occasional reference in case of doubt may be made to the maps, 2954. Woodlands and plantations are now separately distinguished, 2955, 2957–60. It is uncertain whether land which has been cleared of its timber but not replanted would be included among woodland, 2960. The Board of Agriculture hope the Committee will give a definition of woodland, 2959 2956, 2961. Foreign methods of collecting the statistics of woodlands differ very largely, 2962–4. There are not many students of forestry in this country, 2972–4. The demand for agricultural edutcation has greatly increased of late years, 2977–81; it does not follow that an increase in planting would result from increased means of education, 2982–6.

Appendix XIII.—Note on the Board of Agriculture's powers with reference to loans for planting; App. XIV.—Returns of Woods.

Creosoting.—Margerison, 182; Havelock, 879–80, 911–4; Roberts, 3740–1, 3749–50; App. VII., XVIII.

Crown Woods.—Forbes, 1345–8, 1361–5; Robertson, 1596–7; Schlich, 2279–84, 2293, 2296–8, 2321–2; App. I., XXI.

Croxford, J. H. (Analysis of his Evidence.)—Is a member of Messrs. Price, Walker, and Co., timber importers, Gloucester, 2727–9. English timber cannot compete in quality or price with the bulk of imported timber for building, 2730, 2733. English oak, ash, beech, and elm, are superior to foreign, 2731; none of these are in sufficient quantity to supply the home market, 2732. Foreign timber of some classes will, owing to scarcity, some day be more expensive than English, 2734–5, 2757–9. There is no falling off in the quality of foreign timber, 2735, 2755–6. The home demand is increasing, 2736. The price of foreign timber is gradually rising, 2737, 2756. No English timber can compete with Canadian spruce for cheapness at present, 2738, 2745–8. Foreign timber is carried by rail at lower rates than English, and is handled easier, 2738, 2751–4. Terminal charges are also much less, 2753–4. Witness imports his timber dressed, 2739. English saw mills are, as a rule, up-to-date, 2740–1. The practice of importing wood manufactured as compared with the round is increasing, 2743. It will be possible to grow more timber at home, especially of the slow growing woods, 2744. Witness does not import larch, only timber that competes with it, 2745. English purchasers consider only the cost, not the durability, 2747–9. Much foreign wood is artificially seasoned, 2750. Less Ottawa pines come in than formerly, 2755. Witness imports spruce, 2738, 2745, 2760–4. French timber is imported cut ready to go in to the pits, 2762. The timber witness imports is all dressed, 2762–5. Witness has not noticed any falling off in the dimensions of the big logs imported, 2766–8, though the diameter of Canadian white pine logs has fallen off somewhat, 2769–71. The gradual increase in cost is due to much of the timber being cut at a distance from the ports, 2767, 2772. The foreigner puts his goods on the market here, and knows his business better than the home people, 2773–5. Witness's partner has tried planting in Gloucestershire, but stopped because his plantations, on land not worth 2s. 6d. before, were assessed at 10s. per acre, in addition to the agricultural rates of 1s. 3d., 2775–9. There is a timber famine ahead, in both coniferous and hard wood, 2780–1. There is a great deal of felling and very little planting of the slower growing trees in England, 2781.

Davidson, J. (Analysis of his Evidence.)—Is Secrefary to the English Arboricultural Society, and manages the woods on the Derwentwater property in Cumberland, 1922–3, 1935. The English Arboricultural Society give a certificate for forestry, which is not much taken advantage of, 1897–9, 1948–57. The excursions of the Society are instructive, 1900–1. Forestry is holding its own in point of area, and more interest is being taken in it, 1902–6, 1939–40. A well-grown wood will always give a return, 1907–9. Forestry is not on a business footing now, 1910–11. There should be State forests; the existing area will not be much extended by private owners, 1912–3. One or more of these State forests should be available as a demonstration area, 1914. The extension of the forest area would help to maintain a country population on the land, 1915, 2004–27. Timber can be grown up to quite 1,800 feet on the Derwentwater property in Cumberland, 1916–21. On the Derwentwater property, the timber is felled when ready, and the land is being planted, 1922–9. Proprietors might plant if loans were granted by the State, subject to inspection, 1930–3, 2027–31. The English Arboricultural Society has increased very much since it was founded 21 years ago, 1935–42. The Society will make an excursion to France this year, 1943–6. Acquaintance with continental methods would be an advantage to English forestry, 1947. The examinations of the Society are practical as well as theoretical, those of the Highland Society only theoretical, 1948–57. Education is best given in an experimental forest with a school there, 1958, 1969. State forests should be run on practical lines, and illustrate the various systems, 1959–62. An area of not less than 4–5000 acres is required, with variety of soil, aspect, &c., 1963–8. Working foresters would have to be helped with scholarships 1970–2. It would be a good thing if the students could at the same time earn wages in the demonstration forest, 1973–7. The Northumberland County Council have provided classes for working foresters, 1978–80, 2059–62; the attendance at these was satisfactory, 1981–5. Such a system might be extended, 1986, 2001–3. The Northumberland County Council have also experimental forestry plots, amounting to about 10 acres, on their experimental farm, 1986–96. Other County Councils with similar agricultural farms should set apart plots for forestry experiments, 1997–8, 2001–3. County Council scholarships for forestry might also be given as in Northumberland, 1999–2003. Pastoral hill land in Northumberland carries about 1 sheep on 2 acres, the rent runs to about 2s. per sheep, or 1s. per acre, with about 1 shepherd to 1,000 acres, 2004–20. To put this land under woods would not interfere very greatly with sport, 2014–5. The labour on land stocked with trees costs about £5 per 20 acres annually, so that it takes about 200 acres of forest land to maintain one man with his family, 2021–5. So that land under forest maintains five times as many men as that under sheep in Northumberland, 2026–7. The State already provides facilities for borrowing money through the land improvement companies, but their rate of interest is too high, 2028–30. Corporations should plant the catchment areas of their water supplies, 2032–3; they generally remove all inhabitants and live-stock to prevent contamination, and so leave the area unutilised, 2034–7; while planting these areas would improve the supply and purity of the water, 2038–42. There is too little planting generally in England, 2043–8. Timber can be grown profitably on land which will not pay otherwise, 2049. The market value of residential estates is increased by being well wooded, 2050–2; so that apart from the value of the timber, planting forms a good investment for trustees 2053–4. The value of adjoining agricultural land is also improved, 1921, 2054–7. With plantation in the neighbourhood tenants know that their fences will be kept up by the proprietor, and will pay a better rent, 2057. In the neighbourhood of towns plantations, when they are up, add to the value of building sites, 2058. The examinations of the English Arboricultural Society are mostly attended by men working in woods, 2058–9. Parts of North Wales might advantageously be afforested, 2063–5. Foreign stocks of timber are being depleted, 2066–8. Prices have gone down in the past forty years, 2069–71; though there has been a rise lately, 2072.

Dean Forest.—App. I., XXI.

Death Duties.—Bailey, 406–7; Selborne, 590; Forbes, 1354–7; Minchin, 3142–86; App. I., XV.

Deer, injury by.—Ramsden, 695–8; Schlich, 2336–7; Michie, 3394; App. XI.

Deer Forests.—Ramsden, 710–7; Michie, 3482–91.

Deforestation, legislation concerning, in foreign countries.—App. XXVI.

Degrees or Diplomas.—Bailey, 367; Davidson, 1897, 1948–53; Schlich, 2263; Somerville, 2994–5, 3056–9; App. I., XXIII., XXIX.

Dehra Dun Forest School.—Bailey, 357; App. I.

Demonstration Forests, State: (*a*) *Necessity of.*—Bailey, 335–44, 357, 382–6, 414–24, 450–1, 470–1, 502–6, 2787–807; Selborne, 564–7, 589; Ramsden, 622–4, 706–9; Slater, 742–6, 763–81, 826–7; Havelock, 890–7, 913, 1037–41, 1080–5; Forbes, 1151–60, 1226–30, 1261–5, 1290–8, 1339–44, 1358–60; Glanusk, 1396–400, 1475–8; Robertson, 1586–604, 1677–9, 1689, 1859, 1889–93; Davidson, 1914, 1958–69; Vernon, 2111–2, 2147–50, 2194–5; Schlich, 2274, 2280–94, 2310–9, 2363–4, 2381–6, 2402–11; Drummond, 2555–9; Pitcaithley, 2655, 2698–9; Somerville, 3041–7, 3079–81, 3137–41; Michie, 3315, 3328–9, 3334–47, 3366–76, 3380–1; Ward, 3496; App. I., II. (iii., iv., v.), XI., XXII.

(*b*) *Control of.*—Bailey, 360–1, 2791; Robertson, 1738–44; Schlich, 2317–20, 2402–4; Ward, 3514–7.

(*c*) *Suggested localities.*—Bailey, 339–42, 360, 2789–95; Slater, 862–4; Robertson, 1600, 1666, 1782–3; Schlich, 2279–88; Pitcaithley, 2633–5; Michie, 3315, 3340; Ward, 3521–4.

(*d*) *Forest school in.*—Bailey, 342–3, 423, 469–71, 2807; Slater, 742–6, 862–4; Havelock, 1081–5; Forbes, 1299–301; Robertson, 1718–44, 1888–93; Davidson, 1958, 1969; Schlich, 2274, 2350–2; Pitcaithley, 2644–50, 2663; Somerville, 3043–6; Webster, 3188, 3197–9, 3207, 3255–7; Michie, 3315, 3328–9, 3334–47, 3380–1; Ward, 3630–5; App. I., II. (iv.), X.

Depopulation, rural, prevention of.—Margerison, 69–92; Selborne, 593; Robertson, 1807–25; Davidson, 1915, 2004–27; Vernon, 2153–8; Michie, 3421–37, 3471–4; Parry, 3643, 3664, 3679–85, 3692–4.

Douglas Pine.—Ramsden, 612–4; Forbes, 1335; Glanusk, 1415–6; Schlich, 2428–32; Drummond, 2497; Michie, 3451; App. I.

Downton College of Agriculture.—Drummond, 2468, 2612–8; App. I.

Drummond, D. W. (Analysis of his Evidence.)—Manages estates of 60,000 acres, with 3,000 acres of woodland, in South Wales, 2453–6. Has studied at Cambridge and Downton, 2455, 2467. Would have derived benefit if there had been adequate provision for forestry instruction at Cambridge and Downton, 2457–8, 2550–4; and has felt the want of a thorough training in sylviculture, 2459–60. Owner, agent, and forester should all be trained, 2461–2; the agent in the first place, 2463, 2549. Foresters are not sufficiently educated, 2464–6. There was very little forestry training at Downton, 2468, 2612–4 There is not much to be learnt from the New Forest, 2468. The price of wood is low in South Wales, 2469; partly from expensive transport, 2470. Traction traffic on roads has not been tried, 2471, 2474. There is much foreign competition in pitwood (pinaster) from France, 2472–3. Several of the woodlands in South Wales have been planted for commercial purposes, 2475; but in too small areas, 2476. There is a large area of waste land in the west of Wales, partly belonging to the Crown, which could be properly planted, 2477, 2569–70, 2578. Grazing rights are a difficulty, 2478, 2503–5, 2531–9, 2592–609. Landowners will not plant without some encouragement, 2479–80. Some assistance in the rates should be given, 2480–1. Rates and taxes are between 7s. and 8s. per acre, 2482–3. Landowners want evidence that planting will pay, 2483–4. Proper book-keeping of the plantations is not kept, 2485–6. The State should undertake planting, 2487–8, 2569–70. A good course in sylviculture at the university would be a great advantage, 2489, 2550–9. A practical training is very important, 2489–92, 2554–9. Larch disease has been very serious in South Wales, but they are recovering, 2493. Witness mixed larch with Scots fir or *Laricio*, 2494–7. Spruce does very well in his county, 2497. Foreign pitwood comes in at 6s. to 7s. per ton, 2473, 2498. Larch fetches a better price than foreign wood, but the latter comes prepared exactly to suit the market, 2499. Plantations should be relieved from rates until the returns begin to come in, 2500–2. The sheep are of a very inferior class, 2505. A Government bounty would conduce to planting, 2506–7. It is very difficult to get labour in South Wales, 2508–11, 2591. Nurserymen will take a contract for planting, but it is better to employ one's own men, 2509–11. Fencing costs about 1s. per yard, 2512–3. Fencing is correctly charged to the forests, 2513. It is difficult to keep the sheep out of the woods, 2514–5. Timber would be more profitable than grazing in South Wales, 2516–7. Tenants would also gain by the shelter, if certain areas were taken into forests, 2517, 2599–603. Coal is exported from Carmarthenshire in French vessels, which bring in pitwood as ballast on the return journey, 2518, 2565–6. The plantations suffer from excessive rainfall, 2520–2. The pitwood grown locally is chiefly larch, 2523–4. More spruce might be planted with advantage, 2525–30, 2560–3. A good deal of spruce is imported, very much for building purposes, 2526–9. The grazing rights are not an insurmountable difficulty, 2531–9, 2603–9. Liverpool cleared its waterworks area entirely of the grazing rights, 2536–8. There is great mismanagement in South Wales, 2540–2, 2590. Felling areas are replanted as quickly as possible, to conserve the fertility of the soil, 2543–6. Our knowledge of forestry is behindhand, 2547–8. Students at the universities and colleges might get their practical training abroad until we had the necessary instruction areas in this country, 2555–9. Larch makes the best pitwood because it will stand a much greater strain than other woods, 2563. Spruce is better than pinaster for pitwood, 2564. The Board of Agriculture should publish pamphlets on forestry and an elementary handbook, 2567–8. There are very few plantations above 800 feet under witness' management, 2571–2. Railway rates are high, but witness cannot speak as to any preferential rates, 2573–5. Local authorities place difficulties in the way of traction haulage, 2576; and make claims for extraordinary traffic, 2621–3. There is not much trouble with game in South Wales, 2577. The Land Improvement Companies' loans are not taken advantage of for forestry, 2579–83; witness has not met with a single case during the 11 years he has been Inspector under the Board of Agriculture, 2579–83. By "waste land" witness means the unenclosed mountain land, 2584–5. There is no increase in forestry in South Wales, 2586–8. The

Government should take some steps to call attention to the subject, 2568, 2588. Owners should be obliged to replant as much as they cut down, 2588–9. Witness plants as much of the unproductive areas as he can on the estate under his management, 2590–2. The tenants of farms in the valleys have grazing rights on the hill land, which often belongs to a different owner, 2531–3, 2592–2609. Instruction in forestry would be better given in connection with the agricultural colleges than at a university, 2610–1. Some instruction on subjects connected with forestry is given at Downton, but forestry lectures were introduced since he was there, 2612–8. It would be a great advantage if these colleges had an area for practical instruction, 2615–6. Practically all the rough ground in Wales is subject to grazing rights, 2619–20. The agent is responsible to the owner, but as he cannot know everything the head forester is important, 2624–7. Many farms in South Wales do not pay a rent equal to the interest on the fixtures, 2628. Witness would not plant land bringing in 10s. or more per acre, 2629.

Appendix X.—Particulars of estates managed by witness, trees planted, prices, markets, railway rates, local taxation. Much waste land might be afforested, and areas felled should be replanted. No hard woods are being planted in South Wales, as larch and conifers give a much quicker return. The Board of Agriculture should issue publications. Training of foresters is a necessity. Rates on woodlands should be remitted, or a bounty given. There should not be a separate State school of forestry, but education should be given at the agricultural colleges and universities. An 18 months' course should be given, as well as short courses of three months.

DUNES, afforestation of.—App. II. (xiii.), XXVI.

DURHAM College of Science.—Somerville, 2994, 3056, 3066–9.

EDINBURGH : (a) *University*.—Bailey, 335, 360, 367–70, 461–2, 2789–91 ; Slater, 859–64 ; Robertson, 1738, –44 ; Somerville, 3114–5 ; App. I., II. (iv.), XXII.

(b) *Botanic Garden*,—Slater, 782, 857–8 ; App. II. (vi., vii.).

EDUCATION : (a) *Foresters and Woodmen, existing facilities for training*.—Bailey, 335, 461–2 ; Slater, 782, 857–8 ; Havelock, 916–7, 964–6 ; Forbes, 1266–72 ; Robertson, 1721–6 ; Pitcaithley, 2651–4, 2664–5 ; Somerville, 2990–6, 3005–8, 3049–54, 3099–113, 3133–6 ; Webster, 3193–4 ; Michie, 3361–6 ; App. I., II. (vi., vii.).

(b) *Foresters' requirements*.—Margerison, 37, 125–36 ; Bailey, 335–8, 349, 425–32, 467–71, 2806–7 ; Selborne, 576–8 ; Ramsden, 608, 646–8 ; Slater, 742–6, 771–89, 815–27, 841–64 ; Havelock, 952–70, 1015–8, 1076–85 ; Forbes, 1142–60, 1186–8, 1218–30, 1273–8, 1299–307 ; 1314–28, 1371 ; Robertson, 1587–92, 1718–41, 1860–5, 1886–93 ; Davidson, 1970–2003, 2059–62 ; Vernon, 2092–9, 2139, 2142, 2190–3 ; Schlich, 2274, 2310–7, 2350–2, 2387–8, 2406–9 ; Drummond, 2461–6 ; Pitcaithley, 2644–50, 2663–7, 2673–89 ; Somerville, 2990–3, 3041–4, 3100, 3138–41 ; Webster, 3188, 3195–9, 3207, 3233, 3255–7, 3266–8 ; Michie, 3314–31, 3341–76 ; Ward, 3553–641 ; Parry, 3676–7, 3696–7 ; App. I., II. (iv., viii., x., xiii), VIII., XI., XVI.

(c) *Land Agents and Landowners, existing facilities*, see below (g).

(d) *Land Agents and Landowners' requirements*.—Margerison, 125–36 ; Bailey, 342, 349, 416–36, 467–72, 2806–7 ; Selborne, 514–6, 520–4 ; Ramsden, 608, 632–5, 646–8 ; Slater, 783–9, 847–56 ; Glanusk, 1396–400, 1475–8, 1497–8, 1557 ; Robertson, 1589–92, 1891–4 ; Vernon, 2092–8, 2142, 2190–3 ; Schlich, 2274, 2295, 2331, 2346–7, 2354, 2381–3, 2439–41, 2444–7, 2452 ; Drummond, 2461–4, 2549–59, 2610–8 ; Somerville, 2990, 2998–9, 3041–4, 3126–9, 3138–41 ; Webster, 3202 ; Michie, 3326–31, 3341–5, 3358–60 ; Ward, 3500–6 ; App. I. (See also (h) below).

(e) *Lectures, local*.—Bailey, 335, 387–92, 458 ; Forbes, 1302–7 ; Davidson, 1978–86, 2059–62 ; Vernon, 2211–3 ; Schlich, 2387–8 ; Somerville, 2990–6, 3005–8, 3049–51, 3054, 3076–8, 3099–113, 3133–6 ; App. II. (iv.) VIII.

(f) *Scholarships*.—Bailey, 367 ; Davidson, 1970–2, 1999–2003 ; Somerville, 2991, 3009, 3012–7 ; App. I.

(g) *Universities and Agricultural Colleges, existing provision*.—Bailey, 335, 342–3, 367, 461–2 ; Ramsden, 634–5 ; Drummond, 2457–8, 2468, 2550–4, 2612–8 ; Craigie, 2910–4, 2967–74 ; Somerville, 2994–7, 3008–11, 3018–22, 3056–8, 066–71 ; App I., II. (vi., vii.), XXII.

(h) *Universities and Agricultural Colleges, instruction should be given*.—Bailey, 425–36, 482, 2791, 2806–7 ; Selborne, 520–4, 576–8, 589 ; Ramsden, 632–5 ; Vernon, 2211–3 ; Schlich, 2274–8, 2282–6, 2353–5, 2439–50 ; Drummond, 2489, 2550–9, 2610–6 ; Somerville, 2992, 2998–9, 3016, 3056, 3072, 3120–8 ; Michie, 3343–5, 3361–4 ; Ward, 3494–5, 3500–6, 3510–4, 3518–20, 3529–43, 3607–9 ; Parry, 3676–7, 3696–7 ; App. I., II. (iv., vi., vii., xiii.), X., XVI., XXII.

(i) *Examinations*.—Bailey, 367 ; Davidson, 1897–9, 1948–57, 2058–9 ; Somerville, 2994, 3056 ; App. I.

(k) *Excursions abroad*.—Slater, 821–5 ; Havelock, 977–8, 1037–40 ; Robertson, 1662 ; Davidson, 1943–6 ; Schlich, 2274, 2290, 2452 ; Drummond, 2554–6 ; Ward, 3496, 3500–2, 3547–8 ; App. I.

(l) *Foreign countries*.—*Austria* : Bailey, 423. App. II. (v.). *France* : App. I., II. (i.). *Germany* : Forbes, 1143–7, 1151 ; Ward, 3514–7, App. II. (v.), XXIII., XXIV., XXV., XXVI. *Hungary* : Bailey, 454–7, App. II. (ii.). *India* : Bailey, 357 ; Schlich, 2290–2, 2355–7 ; App. I., II. (v., xi.). *Spain* : App. I. *United States* : Schlich, 2263 ; App. II. (xi.), XXIX.

ELM.—Margerison, 181 ; Croxford, 2731–2 ; App. IX., X.

ENTOMOLOGY.—Somerville, 3086–98 ; Ward, 3586–7.

ESTATE DUTIES, see *Death Duties*.

EXAMINATIONS, see *Education* (i).

EXAMPLE PLOTS.—Bailey, 335, 343–8, 382–6, 418, 507 ; Forbes, 1336–8 ; Davidson, 1986–09 ; Somerville, 2992–3, 3016, 3055, 3120–2 ; Ward, 3527–8 ; App. XXIII.

EXPERIMENTS, necessity of.—Bailey, 335, 347–8, 382–3, 2803 ; Selborne, 595 ; Slater, 874 ; Forbes, 1248–65, 1308–11 ; Somerville, 3047–8, 3140–1 ; Michie, 3467–8 ; App. I., XXIII.

EXPERTS (for home and colonies).—Bailey, 472–6, 2819–20, 2827 ; Selborne, 508–10, 525–30, 568–70 ; Ramsden, 606–7, 672–7 ; Havelock, 959–70, 1123–5 ; Forbes, 1281–2 ; Glanusk, 1549–57 ; Schlich, 2274, 2296, 2335–6, 2425–7 ; Somerville, 3038–40 ; Michie, 3332–3, 3382–5 ; Parry, 3643–6, 3729–30 ; App. VIII., XX., XXV., XXVIII.

EXCURSIONS abroad, see *Education* (k).

EXTRAORDINARY TRAFFIC, Claims by Local Authorities on account of.—Margerison, 301–4 ; Havelock, 1069–70 ; Forbes, 1352–3 ; Drummond, 2576, 2621–3.

FENCING.—Ramsden, 618–21 ; Havelock, 877–8, 897–8, 971–6, 1019–22, 1094–7 ; Glanusk, 1382–3, 1513–7, 1538–9, 1561–2, 1572–3, 1578 ; Robertson, 1625–32, 1830–3 ; Vernon, 2083 ; Drummond, 2512–3 ; App. I., XI.

FIR, see *Pine*.

FISHER, Prof., report on Lake Vyrnwy plantations.—Parry, 3643.

Forbes, A. C. (Analysis of his Evidence.)—Is forester to the Marquess of Bath, 1141. Has had training in Edinburgh and at Eberswalde, from which he derived much benefit, 1142–5, 1266–72. Among foresters who take an interest in their work there is a desire to get training, 1146–9, 1186–8, 1371. The best way for landowners to get foresters is to get men recommended from good estates, 1148–50. Object lessons are more important than theoretical instruction, 1151. A State demonstration area would not meet all requirements, 1152–6; it would not include much of the work usual on residential estates, 1154–60. Government should grant loans for afforestation, mature or nearly mature timber being mortgaged as security, but the land itself should not be burdened, 1161–79, 1197–210. Higher instruction should be given at a few centres, and local demonstrations at many, 1180–2. The Board of Agriculture should issue a special forestry supplement to its Journal, 1183–5. The forester generally has to take his orders from the landlord or agent, 1188–93; but these have not generally much knowledge, 1193–6. Under the present system of loans, under the Land Improvement Acts, there is no inspection once the loan is obtained, 1197–1203. Inspection should continue after the loan is made, 1204–6, 1279. Many landowners would take advantage of loans, 1207, 1280. Government should form forests by purchasing or leasing land in agricultural districts where there is not 5 per cent. of woodland, 1211–13. Absence of a regular system of working woods causes great financial loss, 1214–5; this is generally recognised by foresters, but not by owners, 1216–7. The managing foresters, but not the woodmen under them, are anxious to learn, 1218–21. The first stage of the education of foresters should take place in private woods, 1222–5. Private woods cannot be relied upon for continuity of good management, 1226–8; a Government demonstration area would be an advantage, 1228. In suggesting Government forests witness had not thought of making them educational, 1229–30. Many owners hesitate to clear and replant old woodland, 1231–2. In many cases woods remain standing after they have ceased to add profitable growth, 1233–4. There should be a standing forestry committee in the Board of Agriculture, to collect and publish information and carry out experiments as to the most profitable species to grow, 1235–47. Such experiments could only be conducted in short rotations in private forests, 1248–54; changes of management would render the results risky, 1254–7; and it would be better to carry out such investigations in forests owned by the State or by large corporations, 1254–61. Experiments can be carried on in conjunction with a demonstration forest, 1261–5. Young foresters should begin with a practical training in a forest followed by two years' technical training, 1273–8, 1314–22. Many foresters would be glad to call in the advice of an expert, 1281–2; and the existence of such experts would be a great advantage, 1283–8. The condition of forests in this country is bad, 1289. It should be possible to interest landowners in improving their woods by showing what could be done in a demonstration forest, 1290–8. Sporting is a necessary evil, 1293; the woods could be improved without limiting the sport, 1294; rabbits are excluded from this statement, 1295–7. If there were a school in connection with the demonstration area, young men could begin by being apprenticed there, 1299–1301; meanwhile it would be an advantage to have local lectures, 1302–5. Many men in witness's neighbourhood would go to such lectures, 1306–7. Landowners might form associations to start experimental stations, 1308–10. The experiments should be arranged according to the facilities for carrying them out, 1311. Oaks do no good on clay land in his district, 1311–13. Young foresters should be trained on an estate under a thoroughly competent forester, 1323–8. Forestry pays well at Longleat, 1329. Larch in his district gives the best return at 40 years, and fetches 1s. a foot, 1330–4; Douglas fir also does well, 1335. County Councils might give demonstrations, 1336–40. A State forest is the best system, and witness suggests an alternative failing a State forest, 1341–4. The New Forset is practically waste, 1345–7, 1361–5. The existing State forests are of no value for educational purposes, 1348. Salaries of foresters are not sufficient to render any expenditure on training remunerative 1349–51. Traction engines are necessary, but owners are constantly having claims made against them for extraordinary traffic, 1352–3. Death duties are a great drag on forestry, because the expenses on woods are reduced in order to pay the duties, which disorganise the working, 1354–7. A demonstration area should be chosen to show the best results, 1358–60. There is much waste or poor land which could be profitably put under timber, 1366–9. There has been improvement in the methods of thinning woods, 1370. It was not generally realised ten years ago that treatment which would suit one kind of timber would not suit another, 1372–7. The cultivation of larch has had a deteriorating influence upon sylviculture, 1378–80.

Appendix VIII.—Suggestions for the improvement of British forestry: (1) Appointment of a standing committee on forestry by the Board of Agriculture, with a staff of consulting experts; (2) advance of loans to landowners by Government; (3) formation of State-controlled forests in rural districts containing too small a proportion of woodland; (4) practical demonstrations in the woods, and short course of lectures on sylviculture to working foresters and woodmen in convenient centres.

Forest School, see *Demonstration Forest* (*d*).

Foresters and Woodmen, knowledge and need of education.—Margerison, 26–35, 125–32; Bailey, 336–8; Selborne, 533–4, 581–6; Ramsden, 646–8; Slater, 755–62, 768–72, 870–1; Havelock, 1014–8; Forbes, 1146–9, 1218–21; Glanusk, 1390–1400; Robertson, 1605–11, 1715–7; Vernon, 2093–8, 2190–3; Drummond, 2464–6; Pitcaithley, 2688–90, 2714–21; Webster, 3206, 3266–8; Michie, 3314–5, 3325, 3361–6.

See also *Education* (*a*), (*b*).

Forstgarten, see *Example Plots.*

Fox Coverts.—Craigie, 2945–53.

France: (*a*) *Education in.*—Bailey, 342. App. I., II. (i.).

(*b*) *Forestry.*—App. II. (i., xi., xiii.), XXVII.

(*c*) *Imports of pitwood from.*—Drummond, 2472–3, 2518, 2565–6; Croxford, 2762.

(*d*) *Legislation regarding forests.*—App. XXV.-XXVI.

Fungi.—Somerville, 3086–98; Ward, 3586–7.

See also *Larch disease.*

Gales.—Bailey, 373; Schlich, 2333–6; App. I.

Gamble, J. S. The Forestry Exhibition at Paris and some of its lessons.—Exhibits by French Government; afforestation of sand dunes and mountain slopes; Russian forests; economy of refuse material; importance of education; wood-pulp industry; steps taken in United States and Canada to preserve forests; State forests; forest societies: App. II. (xiii.).

Game (see also *Rabbits*).—Bailey, 335; Selborne, 518, 549–53; Ramsden, 695–8, 737–8; Havelock, 877–8, 884–6, 978–9, 1023–6, 1101–4; Forbes, 1293–4; Robertson, 1633; Drummond, 2577; Pitcaithley, 2708; Webster, 3191*, 3208; Michie, 3336–9, 3478–91; App. I., II. (ix.), III., VII., XI., XIX.

Germany: (*a*) *Education.*—App. II. (v.), XXIII., XXIV., XXV.

(*b*) *Legislation regarding forests.*—App. XXVI.

(*c*) *State forests*, area and finances.—App. XXVII.

(*d*) *Timber supplies.*—Schlich, 2259; App. II. (xi.).

Giessen University.—Regulations concerning instruction in forestry; scheme of lectures, 1901–3; description of the University example plots (*Forstgarten*); App. XXIII.

Glanusk, Lord. (Analysis of his Evidence.)—Is a landowner in Breconshire, 1381–2. Larch is very profitable under favourable conditions, 1382. It should be planted in not less than four acre plots, otherwise the cost of fencing is too heavy, 1382–3, 1516–7. Clearing in Breconshire costs about 10s. per acre, 1383. A plantation of 4 acres costs £39 to fence, 1383, 1421–6, 1513–7, 1531–44, 1560. In his 4 acre plantation, witness made £46 after ten years, after 20 years he gets from another thinning, for pit props, £57 10s.; and sold the whole 4 acres at the end of 45 years for £400, 1383. This gives a return of 3 per cent., and an annual rent of 18s. per acre, 1383, 1518, 1574–5. The rent of this land would be 15s. to 18s. per acre, 1441, 1485. Land after larch is only fit for a second crop of larch, which would probably not yield so large a profit, 1383, 1454–57. Rabbits are very costly to exclude, 1383. It would not be profitable for Government to plant the Welsh hills, 1383. Witness's grandfather planted 50 acres at a cost of £400, with a resultant loss of £1,130, 1383. Profitable planting could probably be done up to about 1,000 feet, 1384–6, 1464–74. Larger plantations, though saving in fencing, would not enable one to go to higher altitudes, the lower trees would not shelter the others, 1388–9, 1471–4. Planting is well done in Wales, 1390, 1479–84. Landowners and land agents have not the technical knowledge, but the land agent knows more about prices than the forester, 1391–5. Timber is sold sometimes by auction and sometimes by tender, 1395. There would not be much advantage in a State demonstration forest and higher education, 1396–1400, 1475–8. Landowners can get a sufficient knowledge by going into an agent's office, 1399. The training that foresters get now is sufficient, 1400. Forty-five years is about the paying rotation in Wales, 1401. Squirrels and rabbits do most harm in Wales, 1402–3. Rates are rather high, but not a bar to plantations, 1404. The tithe is much less than 2s. per acre, 1404–8. Sheep walk rights on the hills would interfere with planting, 1408; it is the custom in Wales for tenants of land lower down to have a right of running sheep on the mountains, 1408–10. Larch disease exists in the neighbourhood, but witness has not himself had much loss from it, 1411–4. There seems to be more disease on the Silurian than on the old red sandstone, 1435. Douglas fir grows quickly, but is not so profitable as larch, 1415–6. It is customary in Wales to let land lie for two years after felling, to "let it see the sun," 1401, 1417–21. Planting costs about £10 per acre, 1421–3. One man plants about 400 trees per day, 1424–6. Has no experience of injurious insects being introduced in imported timber, 1427. Witness plants larch pure after larch; this is better than mixing it with other trees, 1428–34, 1457–63. Labourers in woods get about the same wages as ordinary agricultural labourers, 1436–40. The hill land yields no rent; it is common land, used for sheep walks and sporting purposes, 1441–4, 1486–9. Much pitwood is imported into South Wales, 1393, 1445–53. Witness' larch thinnings at 20 years old are sold for pitwood, 1451–2. Witness plants trees, purchased as seedlings, and grown in his own nurseries up to four years of age, 1383, 1394, 1480–3. Witness has only grown larch for profit, 1387, 1490–5. Witness's opinion as to present methods of education being sufficient is only based on his experience with larch, 1497–8, 1557. The plantations which failed are high up, exposed, and there were difficulties of transport, which probably diminished the price obtained for the timber, 1499–1508, 1545–8. It does not pay in Breconshire to plant land worth more than 5s. to 8s. per acre otherwise, 1508, 1576–80. Prices have fallen very much, 1393, 1449, 1509–12, 1535–7. The grazing rights attached to the farms would interfere with planting the hill lands: it would be very difficult and unpopular to expropriate these rights, 1519–27, 1558–9, 1565–71. If the Birmingham Corporation has bought these rights on the gathering ground of their water supply, hill-planting might be tried there as an experiment, 1528–30. To protect against rabbits adds £2 per acre to the fencing, 1402, 1538–9. The prospects of timber growing in South Wales are good, 1538–40. The area under woods in the county is being slightly extended, 1541–2. Interest was always taken in forestry in the county, 1543–4. Witness has not called in expert advice, and does not know where to get it, 1549–57. Plantations have to be fenced against sheep, 1561–2, 1572–3. The hills are not overstocked withsheep 1563–4. Snow drifts enable rabbits to nibble the tops of trees 14 feet high, 1578.

Gorse planting.—Craigie, 2945–7.

Grazing: (a) *Rights of tenants over moorland, etc.*—Glanusk, 1408–10, 1441–4, 1486–9, 1519–30, 1558–71; Drummond, 2478, 2503–5, 2531–9, 2592–609, 2619–20; Pitcaithley, 2670–1; Webster, 3214–6, 3227–9; Parry, 3650–6, 3679–87.
  (b) *Value of land, see Sheep farming.*

Grouse.—Davidson, 2014–6; Michie, 3336–9, 3477–9; App. I.

Hares.—Selborne, 549; Ramsden, 695–8; App. I., VII., XI.

Havelock, W. B. (Analysis of his Evidence.)—Forester to the Earl of Yarborough in Lincolnshire, and formerly to Lord Feversham in Yorkshire, 875, 921–3. Has made forestry pay, 876. Is not troubled with game in Lincolnshire, as no expense has been spared for wire netting, 877–8. There are saw mills and creosoting works on the estate, 879–80. The estates produce timber of the highest quality, 881–2. The net profits on the woodlands are probably better than on the agricultural land, when outgoings are considered, 883. In Yorkshire the estates were not entirely clear of game, but rabbits were kept down, 884–6. Rabbits are the chief obstacle to the growth of timber, 887–9. A model forest is wanted, where all the operations of sylviculture can be demonstrated; a great deal can be learnt by seeing a thing, 890–7, 913, 1037–41. It is difficult to get proper book-keeping in forestry, estate offices put the expenses of other things down to the woods, 897, 1098–1100. Fencing ought not to be all charged to the woods, 897–8, 1096–7. The whole expense of well-kept roads is also charged to the woods, although all that is required is a rough road sufficient to get the timber out, 899. Woods on gathering grounds of water supplies increase the quantity of water, 900–1. Woods are rated above the value of the land, 902–4, 936–42, 994–999. They ought to be rated only on the agricultural value of the land, or only rated when yielding income, 1000–6, 1105. The woods under his charge are well laid out for getting the timber out, 905–7 Traction haulage is economical, 908–10. Railway charges are excessive, 911, 915; they were one of the reasons which led to Lord Yarborough's setting up a creosoting plant for the timber used on the estate, 911–3. Creosoting effects considerable economies, 912–14. Many young foresters are keen to be educated; at present, they are trained under older foresters, 916–7, 964–6. All classes need education, 918. Landowners are interested, but generally lack knowledge, 919–20, 986. Careful accounts are kept at Brocklesby, and shew the woods to be profitable, 924–8. There is practically no copse-wood, the other kind pays better, 929–30. There is sufficient local demand for what copse-wood they have, 931–2. A visit to Castle Howard taught him to plant more thickly, 893–4, 933–5. There should be a good central road in a large plantation, but otherwise roads should only be made when needed to get the timber out, and the ruts filled up afterwards, 899, 943–5. The distance from the station is a more important factor in the price obtained for the timber than the state of the roads, 946–7. The timber on the estate is sold publicly, by preference, either by tender standing, or by private tender felled, or public auction, 948, 1042–46. Prices have improved of late years, 949–50. There is not much larch disease in Lincolnshire, 951. Witness is in favour of providing technical education for head foresters and their sons, but most of the men under him in Lincolnshire do not show much desire for it, 952–7. There are not many openings for trained men, 959–63. Landowners and younger foresters would probably take advantage of expert advice if it were available, 967–70. Fencing against rabbits is a delusion, 971–6, 1019–22; keepers have been known to make holes in the netting, 973, 1020–22. Rabbits have become more artful, and it takes a higher netting to keep them out than formerly, 972–6. German methods could be adopted in this country with advantage; but the game question in many cases precludes it, as foresters are often obliged to thin so as to secure bottom cover for game, 978–9. With instruction, forestry could be made much more profitable, 979–80. Large areas might be planted, 981; the State might profitably plant such lands, 982–8. Witness does not believe in State loans for planting, as, owing to the necessary supervision State and landowner might come into conflict, 982–4. The woods at Brocklesby are between 5,000 and 6,000 acres, and have been regularly managed for over 100 years; the expenses are not half the receipts, 989–94. The sessile oak would probably thrive better on some high ground Brocklesby than the pedunculated oak. 1007–13. Even on a well-managed estate like Brocklesby mistakes have been made, 1006, 1014, which might be avoided by means of education, 1015–18. If owners had a clear idea of the damage done by game it would have a beneficial effect, 1023–6. Forests are often unprofitable because owners take out the best young trees to supply orders, 1027–30; or leave them after they have ceased to grow profitably, 1031: working plans would remedy this, 1032–3, 1117–8. On large estates there is plenty of room for growing profitable crops of timber without interfering with the artistic beauty of parts near the house or along the drives, 1034–7. Hedgerow timber rather beautifies the estate than is a profitable crop, 1047–8. The 1s. per foot obtained for ash (see App. VI.) was a low price because the timber was small and rough, 1049–50. The labourers in the woods get more than ordinary agricultural labourers, 1051–2. There is no scarcity of labour, 1053–4. There is a good demand for the timber at Brocklesby, 1055–63, one reason being that the sales there have been a regular thing for many years, 1063. The timber trade is rather slack at the present moment, 1059–61. The woods are 2 to 6 miles from the railway station, 1064–5. The timber is hauled by traction engine on the public roads, but all on the property, 1066–8; local authorities do not impose any restrictions, but sometimes owners are handicapped by bridges being scheduled, 1069–70. Timber merchants do not seem to use traction engines much, 1071–5. There is a demand for education in forestry, 1076–9. Young foresters should be trained for a year or two in an experimental area, where they would receive wages for work performed, 1080–5. A demonstration area is wanted to show how things should be done, 1086–91. Larch pays earlier than ash, but in some woods larch has been mixed with ash, the larch being afterwards taken out, leaving a fine crop of ash, 1092. Ash thinnings at 30 years of age are easily-marketable, 1093. It is possible to use wire netting against rabbits twice over, 1094–5. Shooting rents are not credited to the woods, 1101–4. The creation of shelter belts improves the land, 1106–9: and such shelter belts should not be rated because the rates fall upon the improved agricultural value, 1109–12. There is a tendency to convert coppice into high forest now, 1113–6. Witness has seen natural regeneration of beech in Lincolnshire, 1119–21. Trained foresters would be able to give advice to owners, 1123–5. Foresters as a rule are insufficiently remunerated, 1126. Witness has grown oaks by sowing acorns, 1121, 1128–40; though game and rabbits interfere with them, 1133, 1138–40.

Appendix VI.—Particulars of receipts and expenditure of the final clearance of an 18 acre plantation, 75 to 80 years' growth, in North Riding of Yorkshire, felled off in 1890–91.

Appendix VII.—Note on rabbits, game, thinning of woods, present supply of foresters, and creosoting.

Hawks.—Selborne, 517, 549–50.

Hedgerow timber.—Margerison, 171–6, 239–43; Havelock, 1047–9; Vernon, 2242; App. I.

Heriot-Watt College.—Bailey, 433: App. II. (iv).

Hesse: (a) *Forestry Education.*—App. XXIII.

(b) *Legislation regarding forestry.*—App. XXV., XXVI.

Highland and Agricultural Society: (a) *Evidence on behalf of.*—Michie, 3313–3491.

(b) Examinations; Davidson, 1948–57, App. I.

Hopton, C. (Analysis of his Evidence).—Is Vice-President of the Timber Trades Federation, 311. On French and Belgian railways a rebate is given on all timber for export, 312–17. Witness has received beech from Belgium, 318–21. Beech butts are used for wrest-planks in pianos, 322 (and 102–4); but the piano-cases are made of all kinds of wood, 323–4. Witness purchases ash for bending, and finds that only English ash will bend, 325–7. The supply of English timber diminishes year by year, and owing to railway rates merchants are obliged to use foreign in place of British timber, 328. American ash is not suitable for bending, 329. Very little young ash is coming along in this country, 330. Railway rates are 30 to 60 per cent. higher for British than foreign timber, 331.

Horticultural Society, Royal, Evidence on behalf of.—Webster, 3187–3312.

Howard, F. Stafford.—Area under wood of Crown Forests in the United Kingdom, App. XXI

Hungary: (a) *Education.*—Bailey, 454–7, App. II. (ii.).

(b.) *Legislation concerning forestry.*—App. XXV., XXVI.

(c) *Timber supplies.*—Schlich, 2259, App. II. (xi.).

Imports.—Margerison, 124, 137–44; Hopton, 318–21; Vernon, 2116, 2206–10; Schlich, 2258–62, Drummond, 2472–3, 2498, 2518, 2526–9, 2565–6; Croxford, 2729–81; Roberts, 3734–5, 3743–66, 3777–8, App. II. (x., xi.), III., X., XVIII.

Probable diminution of, see *Timber* (*d*).

Improvement of Land Acts.—Craigie, 2898–9, 2936, 2940; App. XIII.

India: (a) *Education of students for service in.*—Bailey, 357; Schlich, 2290–2; App. I., II. (v.), XX.

(b) *Forestry in.*—Bailey, 459–60, 2525–6; Schlich, 2290, 2355–7.

Industries, local.—Robertson, 1669–72; Vernon, 2113–22, 2153–8, 2206–9, 2227–31; Michie, 3471–2; Parry, 3643, 3664, 3674, 3691–5; App. I.

Inland Revenue Department, Evidence on behalf of.—Minchin, 3142–86; App. XV.

Insects, damage by.—Bailey, 379; Glanusk, 1427; Schlich, 2379; Somerville, 3086–98, 3132; Ward, 3586–7.

Ireland.—Schlich, 2330–6; Webster, 3288–3312.

Italy, legislation concerning forestry.—App. XXVI.

Japan, timber supplies.—App. II. (xi.).

Kew, training of gardeners.—App. XX.

Knockboy, failure of plantations at.—Schlich, 2333–6.

Labour, demand for, in woods.—Bailey, 335, 404; Selborne, 535–7; Slater, 833–7; Havelock, 1051–4; Glanusk, 1436–40; Robertson, 1612–4, 1667–72, 1816–25, 1878–84, 1895; Davidson, 1915, 2004–27; Vernon, 2215, 2220, 2245–8; Schlich, 2395; Drummond, 2508–11, 2591; Pitcaithley, 2651–4; Michie, 3426–37; Parry, 3692–3.

Land Agents and Landowners, knowledge and need of instruction.—Margerison, 38; Bailey, 349; Selborne, 576–9; Slater, 767, 783–9, 828–31; 847–51; Havelock, 918–20, 986; Forbes, 1193–6, Glanusk, 1391–5; Robertson, 1891–4; Vernon, 2092–9, 2142, 2190–3; Schlich, 2274, 2355, 2440, 2448–50; Drummond, 2457–63, 2540–59, 2610–8; Somerville, 2990, 3025–37; Webster, 3290–2; Michie, 3326–31, 3341–5, 3358–60; App. I., X.

See also *Education* (*d*).

LAND IMPROVEMENT COMPANIES.—Forbes, 1197–1203; Davidson, 2028–30; Drummond, 2579–83; Craigie, 2887–903, 2915–42; App. X., XIII.

LARCH: (a) *Generally.*—Margerison, 195–6; Bailey, 393–5; Ramsden, 658–62; Slater, 790–803; Havelock, 1092; Forbes, 1330–4, 1378–80; Glanusk, 1382–3, 1428–34, 1451–63, 1490–5; Robertson, 1802–6; Vernon, 2082–6, 2237–41; Schlich, 2428–32; Drummond, 2493–9, 2523–4, 2563; Croxford, 2745; Michie, 3402–18, 3448–64; Roberts, 3740–1, 3767–75; App. I., V., X., XI., XVIII.

(b) *Disease.*—Margerison, 83; Selborne, 542–6, 595–7; Havelock, 951; Glanusk, 1411–4, 1435; Robertson, 1798–1804; Schlich, 2436–8; Drummond, 2493; Somerville, 3086–9; Michie, 3404–17, 3454–64; App. I.

(c) *Japanese.*—Selborne, 595–8; Michie, 3412–8, 3448–64.

(d) *Prices.*—Slater, 838–40; Forbes, 1330–4; Webster, 3272–3; Parry, 3643, 3661–2; App. VI., IX., X.

LECTURES, see under *Education.*

LEGISLATION, foreign, regarding forests.—App. XXV., XXVI.

LIME-TREES, utilisation of, in Russia.—App. II. (xiii.).

LIVERPOOL waterworks catchment area.—Drummond, 2536–8; Parry, 3643–732; App. XVII.

LOANS.—Margerison, 308–10; Havelock, 982–4; Forbes, 1161–79, 1197–1210, 1279; Davidson, 1930–2, 2028–31; Vernon, 2088–9; Schlich, 2295; Drummond, 2579–83; Pitcaithley, 2725–6; Craigie, 2887–900, 2915–40; App. I., II. (ix, x.), III., VIII., IX., XIII., XXV.

LOCAL AUTHORITIES, see *Bridges, Extraordinary Traffic,* and *Rates.*

LOCAL GOVERNMENT BOARD, ENGLAND, memorandum by, on rating of woodlands.—App. XIX.

———————— SCOTLAND, Evidence on behalf of.—Maxwell, 2831–86; App. XII.

LOCAL TAXATION (CUSTOMS AND EXCISE) ACT.—Craigie, 2912–3.

MARGERISON, S. (Analysis of his Evidence).—Is an English timber merchant, represents the Timber Trades Federation of the United Kingdom, 1–2. Foreign methods of forestry produce better financial results than English on the whole, though for certain limited requirements the quality of British timber is more suitable, especially where resistance to indentation and durability are required, 3–9, 69–71, 93–108, 185–8. For some purposes foreign timber commands a higher price than British, 10–11. Timber could be grown of as good quality at home as abroad, 12. Coniferous timber should be grown dense, 13–14. Working plans would be an advantage to grower and merchant, 15–17. Regularity in supply and getting the timber into handier shape for transport might result in cheaper railway rates, 18. Canals are not cheaper than railways, 19. Steam haulage on roads is cheaper, 20. Round timber is charged by railway companies at a higher rate than squared, 21, 151–61. Roads are not usually well laid out in the woods for carting away the timber, 22–4. The plant in British sawmills, at least in towns, is probably up to foreign standards, 25. Most foresters and wood managers are qualified to value standing timber, 26–35. Owners and agents seem to know more about the selling value than the management of their woods, 36. Foresters should be trained by attending classes at various centres, 37. Has not come across serious accidents from neglect to provide shelter belts or from improper safeguards on locomotives, 38. We could produce the greater part of the timber we require on land which would yield less under farm crops, 39–43. British oak is better than any other oak, 40. The cost of transport is sometimes equal to the value of the timber, 44, 111–13. Forestry, is doubtful, financially, if the land is worth 7s. 6d. to 10s. per acre for other purposes, but very much depends upon the means of transport to the market, 44. The question of good or bad roads in the woods affects the price a merchant offers for the timber, 45–8. There is increasing difficulty in getting good British oak and ash, 49–52; and the supply is likely to become more restricted in the near future, 53–5. Witness draws his supplies principally from Yorkshire, 56. Some owners replant after felling, and there is a tendency to plant closer, 57–9. There is an increasing interest in forestry among landowners, 60–2. Woods are generally too heavily thinned in this country, 63–4. English foresters are becoming converted to continental methods, 65–8. English beech, grown thin, is denser and heavier than foreign, and so more suitable for certain purposes, 69–71, 93–105. Irish timber is much the same as English, 72–3. The price obtained for small lots of timber is lower because large lots can be transported more cheaply, 74–5, 122. Corporations might plant the gathering grounds of their reservoirs, 76–80. At the present time, oak or ash would probably be the most profitable trees to plant, 81, 164–5, 170. It is not profitable to grow pit wood in Yorkshire, 82. Disease makes larch a risky crop at present, 83. Older foresters are generally prejudiced against education, 84–6. Colliery spoil heaps are planted in few cases, but in many cases the atmosphere is too polluted for trees to grow well on them, 87–8. Afforestation would help to keep the rural population in the country, and gives employment to labourers chiefly at slack times, 89–92. Generally, home timber from hardwoods is for certain purposes better than foreign, 93–5. The value of British beech is roughly 15 per cent. more than German, 96–104; so that the German method would give better financial results if 25 per cent. more timber were grown, 105–6. British beech is used in pianoforte making, 102. Imported coniferous timber is superior to British, 107–8. More coniferous timber is required than hardwoods, 109–10. The cost of transport could be materially reduced by converting round timber into square before removal, 111–21. Foreign supplies of timber will probably fall off in the future, 124. Education is more important for the owner and manager than the woodman, 125–29; the education of the latter, which is also important, will follow, 130–2. The remuneration of foresters should be higher than at present, 133. The education of owners might be more concentrated than that for foresters, 134–6. Foreign timber is more suitable for pit-wood, and is carried at more favourable rates, 137–44. Witness has paid as much as 5d. per cubic foot for cartage of timber, 145–50. With the large areas abroad, the cost of cartage is reduced by slides, tramways, etc., for removing timber, 151–53. Witness's trade is practically all in home-grown timber, 162–3. Ash and oak are the most important to grow so far as regards value per acre, but the demand in volume is greater for conifers, 164–5. The price of ash has not fallen, 166; but Scots pine has fallen about half in the West Riding, 167. In Scotland, or where there are shipping facilities to colliery districts, it might be better to grow pit-props, 168–9. Hedgerow timber is valuable for certain purposes, and can generally be easily transported, 171–6. English oak-timber is a good material for paving blocks, 177–80. Beech and conifers might also be used for wood pavement, 181–84. English oak is preferred to foreign for railway waggons, 185–8. The Timber Trades Federation have not succeeded in getting concessions from railway companies, 189–94. Larch should not be planted close together, 195–6. Some railway companies use foreign oak, because it is cheaper, but English is more durable, 197–202. There has been a fall in the price of oak timber in the past year, but there will always be a good demand for it, 203–9. In converting round timber to square some 33 per cent. is thrown away as slabs and sawdust, 210–21. Round timber does not necessarily contain more water than deals, and this does not entirely account for the difference in rates made by railways for the carriage of round and square timber, 222–5. It is generally more convenient to have the higher grade sawing machinery in the towns than to have saw-mills on the estate, 226. With cheap timbers it might pay as well to use the slabs

for firing the boiler, 227–29. Witness has not had much experience of steam haulage of timber on roads, 230–3; but its use is hampered by local authorities frequently scheduling bridges, 234–8. For certain purposes English hardwoods are preferable to those grown in closer forests, but witness would not make the production of such denser timber the object of sylviculture, as enough could probably be got from hedgerows and the exposed fringes of woods, 239–43. The awkward shape of much English round timber may account for the higher charge of railways, but witness has obtained no reduction by offering to prepare the timber, 244. On shorter runs the terminal charges are relatively higher, but disproportionately so, 245–6. Ash varies much in quality, 247–50. Shake seems to prevail in some districts and soils more than others, 251–3. Frost may be one cause of shake, 254–5. Oak grows well in association with beech, 256–60. Has not noticed if it is less liable to shake under such conditions, 261. Witness does not know of any case in Britain where the purchaser of timber was obliged to replant, 262. Rabbits cause much injury, even to quite old trees, and the injury is often permanent, 263–7. Large areas in Wales might profitably be planted, 268–70. Ash fetches, on the whole, at least as good a price as oak, 271–6. Oak matures at a much greater age than ash, and as the yield per acre would be about the same, the ash is the more profitable, 277–91. Has seen a band of shaken trees running through a wood, on ground slightly raised or slightly hollow, 292–3. Ash of over thirty years may be barked by rabbits, 294–5. Birds ought to be protected by the forester, 296–9; also weasels, stoats, and moles, 300–1. Owners ought to use their rough common timber on the estate, and send only the best to market, 301. Local authorities hamper the timber trade by making claims for extra ordinary traffic, 301–303. Timber merchants try to meet this objection by using broader wheels, 303–4. Plantations pay rates for a long period, while they get no advantage from them, 301. Advantage might be derived from a travelling saw-mill, 305–8. Government might assist the development of waste lands by granting loans under State supervision, 308–10.

Appendix III. (Principally on the relative merits of British and foreign timber.)

Appendix IV. Extract, relating to timber, from the General Railway Classification of Goods, 1902.

Maxwell, J. T. (Analysis of his Evidence).—Is nominated by the Scottish Local Government Board, 2831. There is no official definition of woodlands in Scotland, 2832–5. Woodlands which are grazed and shot over are rated at both their grazing and shooting values, 2836. The grazing value of the wood is rated, the matured timber itself pays nothing, 2837–42. Young wood which cannot be grazed, and therefore is worth nothing, is rated at its full grazing value, 2839. Is not aware of any complaints in Scotland as to rating, 2843, 2851. The Report of the Royal Commission on Local Taxation does not suggest any change as regards woodlands, 2844–7. Railways in Scotland are assessed specially by an official, the deductions in their case are often large, 2848; such deductions involve heavier rates on other subjects, 2849. Woodlands are excluded from "agricultural land" for rating purposes, 2850–1. If there is any deficiency in the amount raised for parish rates, owing to the deductions allowed on agricultural land, the rate has to be raised, 2852–60. In a few parishes, woodlands are treated as favourably as agricultural land, so far as regards parish rates, 2860–2. The guiding principle in assessing land to rates in Scotland is that land planted will make the same return as under grazing, 2863–7. The value of the ground before it was planted is taken as the basis of assessment, 2867–72. Timber does not entirely escape assessment, because it has been paying rates during the time when the trees were young, and the land could not be grazed, 2873–7. The Inland Revenue Officers are in most counties the assessors, and the practice of assessors does not differ widely, 2878–84. The values appear to be on the whole properly fixed, 2883–6; there are two appeal courts, 2885–6.

Appendix XII.—Rating of woodlands in Scotland.

Melard, M., Insufficiency of the world's timber supply.—App. II. (xii.).

Mice, damage by.—Selborne. 517; Havelock, 1133.

Michie, J. (Analysis of his Evidence).—Commissioner to the King at Balmoral, represents the Highland and Agricultural Society of Scotland, 3313. There is great need for forestry education, especially practical, 3314–5. A timber famine is imminent, 3315. An experimental area of not less than 10,000 acres should be obtained in the central part of Scotland, and a school for scientific teaching established on it, 3315, 3328–9, 3334–9, 3380–1. Witness has practical experience of forestry in Scotland, 3316–20; and has control of 6,000 acres of woods at Balmoral 3317–9. Has himself felt the need of training, 3321. There is an absence of proper management, 3315, 3322–4. There is a general desire among foresters for training, 3325. All classes (owner, factor, and forester) want education, but specially the forester, 3326–31. One expert might control the woods of several estates, 3332–3. An area of moorland, if bought for a State forest, would yield some income, from grouse or agriculture, before it was in full working order, 3336–9. Perthshire would be a good centre for a State forest, 3340, 3386–7. Instruction to all three classes should be given at the school, 3341–5, 3360. Scientific instruction could not be so well given at a university, 3343–5, 3361–4. All conditions cannot probably be had at one centre; there should, therefore, be one principal centre for teaching, and other areas might be visited, 3346–7. Foresters should know something of the sciences underlying forestry, 3329 3348–51. The teaching a boy has got in a secondary school would give a sufficient knowledge of these sciences, 3329, 3351; and he should go from there direct into the forest, 3352–3. We shall probably have a timber famine in about thirty years, 3315, 3354–7. Canadian yellow pine, which used to be 1s. a foot, is now worth 5s. a foot, 3356. Factors and owners should be educated sufficiently to understand what the forester proposes, 3327, 3358–9. The maintenance of a school in the forest to give a scientific training would be expensive, 3342, 3361–4. Men who have been through courses of forestry in Scotland have not a practical knowledge, 3361, 3365–6. If a field of practical instruction could be provided, these courses would turn out better men, 3366–76. If owners were sufficiently educated to realise the value of their words, the remuneration of foresters might improve, 3331, 3377–9. With the means of education a class of well-paid consulting foresters might be found, 3382–5. Land in Perthshire would be expensive, 3388–93. The management at Balmoral has for some time been good, 3394–5. Sheep and deer prevent natural regeneration, 3394. Land could be profitably planted if worth only 10s. per acre, and it might sometimes pay if it were worth £1 per acre, 3396–9. Trees grow profitably on the Grampians up to 1,500 feet, 3400–1; on such land Scots pine is better than larch at high altitudes, 3402–3. Tyrolese larch is better than that from Scotch seed, and resists disease better, 3404–11, 3454–6. Has not seen disease in Japanese larch, but the latter has not yet had a sufficiently long trial to show whether it is disease proof or not, 3412–7, 3448, 3458–64. Japanese larch grows more slowly than native or Tyrolese larch, 3417–8, 3448–51. Native Scots fir is better than the continental, 3419–20. Sheep farming is not remunerative at present, 3421–5. Sheep farms are rented in the Highlands at from 2s. to 5s. per head, 3425. Suitable sheep land there carries a sheep on one or two acres, but they have to be sent away to winter, 3426–8. Forests employ one man to 100 acres, 3429–31; while 1,000 acres find employment for only one shepherd, 3432–5; so that apart from the labour of removing the trees felled, and subsequent industries, such sheep land would support ten times the population if placed under forest, 3436–7. Scots pine grown in the Highlands is as good as Baltic, 3438–9, 3452. The home-grown timber lasts very well; witness knows of timber 300 years old, 3440–1, 3445–7. Where the pine is bad it is due to bad management, 3442–4. The Scots pine may not produce a good timber if grown in unsuitable places, 3443–4, 3452–4. Larch plantations ought to be perpetually replenished by Tyrolese seed, 3455–6. Nursery grounds are sometimes badly chosen, 3465–6. There should be a

State area where experiments are conducted, 3467–8. Natural regeneration is not sufficiently practised in Scotland, 3469–70. With a full crop in the forests, the industries connected with its manufacture would employ a larger population than the actual growth would, 3471–2. The extension of forestry would be the most effective means of solving any land question in the Highlands, 3473–4. There is a very large area in the Highlands which could be profitably afforested, 3475–7. The returns from forestry would compare favourably with the sporting rentals, though they would be deferred, and there would be an immediate loss, 3478–9. Private owners will not afforest, hence we must look to State forests, 3480–81. Afforestation would interfere with deer-stalking, 3482–91 ; though the loss of the shooting rents might be to a certain extent mitigated by planting gradually, 3488–90.

MINCHIN, C. O. (Analysis of his Evidence).—Represents the Inland Revenue Department. The value of agricultural property, for the purpose of estate duty, may not exceed 25 times the annual value, 3143. At first the Inland Revenue Department included the value of all timber on any woodland in such agricultural property, in addition to the pastoral value of the land, 3144–7. Under the system now in force, if the estate is valued at 25 years' purchase, the timber is not brought into the account, 3148–50, 3152–6 ; but if the estate is valued at less than 25 years' purchase, the value of the timber, or such a portion of it as will bring the total value up to 25 years' purchase is added, provided that the total value thus obtained is never greater than 25 times the annual value of the land, 3151–5, 3176, 3181–3. Woodlands are assessed to rates in different ways, according as the land is used for plantations and woods or for growing saleable underwood, 3156–9. Timber in a rich district, where land is worth 25 years purchase, thus escapes estate duty, whereas on poor land worth less than 25 years' purchase, it pays duty, 3160–70. So that the maximum limit of 25 years' purchase becomes, provided there is sufficient wood on the estate, a minimum, 3171–5, 3183. The hope of increased income may be taken into account in valuing for estate duty, 3172–3. The system of taxing the timber (when the land is valued at less than 25 years' purchase) acts as a premium on cutting the timber to pay the death duty, 3176–80. In bad counties land may be valued down to 19 or 20 years' purchase, 3184–6.

Appendix XV.—Memorandum on the official practice as regards the assessment of death duties in respect of timber and woodlands ; with an extract from a succession account of timber felled and sold, and extracts from two estate duty accounts.

MOLES.—Margerison, 300–1.

MORTGAGE of standing timber.—Forbes, 1161–79, 1208–10 ; Pitcaithley, 2725–6 ; Craigie, 2892–6 ; App. VIII.

NANCY, school at.—Bailey, 342, 2804 ; App. I., II. (i.)

NEW FOREST.—Forbes, 1345–7, 1361–5 ; Schlich, 2293, 2321–2 ; Drummond, 2468 ; App. I., VIII., XXI.

NISBET, J. : (*a*) Expert advice to Lord Selborne.—Selborne, 508–10, 525–30, 554–8, 581–6.

(*b*) British Forestry and its future prospects.—App. II. (x.).

NORTHUMBERLAND COUNTY COUNCIL.—Davidson, 1978–80, 1999–2003, 2059–60 ; Somerville, 2990–3, 3005–6, 3017, 3049–55.

NORWAY.—Schlich, 2259 ; Roberts, 3735–7, 3743–6 ; App. II. (xi.), XVIII.

OAK : (*a*) *Cultivation of*.—Margerison, 49–55, 164–70, 271–92 ; Havelock, 1007–18, 1121, 1128–40 ; Forbes, 1311–3 ; Vernon, 2162 ; App. I.

(*b*) *Prices*.—Margerison, 203–9 ; App. VI., IX., X.

(*c*) *Quality*.—Margerison, 40, 177–80, 185–8, 197–202 ; Croxford, 2731 ; Roberts, 3734, 3751–6 ; App. III., XVIII.

ORDNANCE SURVEY.—Craigie, 2907–8, 2929, 2954–66.

OXFORD, as a centre for forestry instruction.—Schlich, 2274–85, 2445–6 ; Ward, 3503–4.

PAPER from wood pulp, see *Wood pulp*.

PARIS EXHIBITION, forestry exhibits at.—App. II. (xiii.).

PARRY, J. (Analysis of his Evidence).—Chief engineer to the Liverpool Corporation Waterworks, 3642. There are probably 14,000 square miles in Great Britain drained by rivers above the points of intake from which water is pumped to towns, including supplies derived from rivers, 3643. The latter source of supply will soon have to be abandoned for sanitary reasons, 3643. Many towns have formed, and now control for sanitary reasons, catchment areas for their water supply, amounting to about 576,000 acres, 3643. These gathering grounds are mostly in hilly, sparsely populated districts, which are peculiarly suitable to the growth of timber, 3643. The first to acquire a catchment area by Parliamentary powers was Manchester in 1879, 3643. The policy adopted to keep these gathering grounds free from pollution is to pull down the farms and residences to a large extent, 3643 ; hence the question arises, what is to be done with these areas, 3643, 3665. Planting would both contribute to the yield of water and give a reasonable return on the capital outlay in purchasing the land, 3643, 3701, 3710, 3715–22, 3731–2. The land usually has to be acquired by compulsion, which increases the cost, though Liverpool got its area by agreement, 3643, 3647–9. Lake Vyrnwy was formed in 1880 ; its catchment area is 18,500 acres, of which 14,600 acres are under 1,750 ft. altitude, 3643, 3711. Up to 1,500 feet there are 7–10,000 acres available for planting, 3711. At first the Corporation planted for ornament, but this was not successful, 3643. Mr. Fisher was then called in, and he made a report and recommendations as to the future management, 3643. These recommendations are being carried out, nurseries are being formed on the property, and 162,260 trees have been planted in the last five years, 3643–4, 3666–7, 3727–8. The total area of the plantations is now 470 acres, 3643. The annual expenditure is now about £200, 3643. There is difficulty with regard to cartage ; witness cannot get more than 4d. for larch, which at the railway station 10 miles away would fetch 1s., 3643, 3661–2. It is hoped to work up the timber locally so as to reduce the amount of cartage, 3643, 3663–4, 3713–4 ; and ultimately special arrangements might be made for the transport, 3712–4. There is an obligation imposed on all waterworks to give compensation water, varying according to the season, 3643. This water gives the means of utilising mechanical power for sawmills, etc., 3643. Village industries should also be established below the watershed to use some of the wood, 3643, 3674, 3695 ; this would be of great benefit to the rural population, 3643, 3664, 3692–4. Has great difficulty in obtaining experienced foresters and technical advice, 3643–6. There is a large field for the training of such men, 3643, 3676, 3729–30. Liverpool acquired all the manorial rights, including grazing rights, 3650–1. Grazing rights are still in existence, but are held by the tenants who are now the Corporation's tenants, and the bulk are above the level of planting, 3650–6, 3679–85. Liverpool paid a fair agricultural value for the land, 3657–8. Does not think it would have paid to plant the area apart from the water question, 3659–60. The land was poor and mostly only good for grazing, 3668–72, 3680–5 ; worth about 1s. per acre, 3709. Engineers do not study forestry, 3675–6. Young men should be apprenticed to good foresters at places like Vyrnwy for most of the year, and attend for a term or so at a technical college, 3676–7, 3696–7. A large population was removed from the site, 3679–85. No difficulty was experienced in securing the grazing rights, 3651–6, 3686–7. The tenants appreciate planting, 3688–9. Large areas are suitable for planting in North Wales, 3689–90. There is much water-power available for industries, 3691. Work in the woods would provide occupation at slack times, 3692–3. Planting can be carried up to any height, 3698–700. Hoped that light railways would have proved more useful for timber, 3702–3. Railway rates are high, 3703–4. Rabbits give much trouble at Lake Vyrnwy, 3705–8. Plantations do not render the water more impure, 3715–8, 3722–4. Sheep droppings are not a serious source of impurity, 3725–6.

Appendix XVII.—Statement showing the number of trees planted on Corporation lands around Lake Vyrnwy, 1896–1902.

PAVING, wood.—Margerison, 177–84 ; App. III.

PHEASANTS, injury by.—Selborne, 552 ; Havelock, 1133 ; App. VII.

PINASTER, imports.—Drummond, 2472–3, 2564.

PINE, SCOTS : (a) *Generally.*—Bailey, 393–5 ; Slater, 790–803 ; Michie, 3400–3, 3438–54 ; App. I., II. (xiii.), VI., X., XI.

(b) *Prices.*—Margerison, 167 ; App. VI., IX.

(c) *Quality* (see also *Conifers*).—Michie, 3419–20 ; Roberts, 3735–9, 3743–8 ; App. XVIII.

(d) *Ottawa pine.*—Croxford, 2755.

(e) *Yellow pine.*—Michie, 3356.

PITCAITHLEY, A. (Analysis of his Evidence.)—Is forester to the Earl of Mansfield, at Scone, 2630, 2657. There are no accurate records of the financial results of growing timber available, though they are very necessary, 2631–2 ; but there is abundant evidence that timber growing has in many cases paid very well, 2633–6. Forests in Scone have always been comparatively well managed, so that the examples of profits obtained there are exceptional, 2636–7. Rabbits were not troublesome in former times, but they are now, 2638–9. Woods in this country have generally been very badly managed, 2640–1. Prices for pit wood were much better 30 to 40 years ago, so that many people realised as much of their woods as possible, 2641, 2672, 2694–6. In many parts of the country, where the land is suitable for planting, the owners cannot afford the capital, 2642. Before increasing the area under timber, it would be better to improve the management of existing woods, 2643, 2662, 2706–7. The first step should be the provision of a forest school, with both theoretical and practical training, the latter coming first, 2644–50, 2685–7. Young men are taken on at Scone to be trained, 2651–4. Witness has no difficulty in getting labour, because the young men who come know that they will be looked after and get an education, 2651–4. A demonstration area should show all departments of the forestry business, 2655. A head forester ought to understand how to work up timber, 2656, 2718–9. Witness makes an estimate of the work to be done year by year, 2657–8. Land making less than 10s. per acre would, if suitable, do better under timber, 2661, 2704–5. Perthshire would be a good centre for a forest school, 2663 ; many foresters are trained there, 2664–5. Foresters would profit by any facilities for training, 2666–7. There is no special increased interest among factors or landowners, 2668. Grazing rights over the rough land would probably not be a difficulty in Scotland, 2670–1. It is essential to give facilities for education to secure the better management of woodlands, 2673–5, 2681. It has taken witness many years to acquire the knowledge he now possesses, 2676–80. The extension of forests will come with instruction, 2681–3. Foresters who have not had a special training are generally ignorant of many operations of forestry, 2688–90. This ignorance is due to their having had no means of acquiring information, 2689. A plantation which had not been thinned was formerly considered neglected, 2691–3, 2697. A scheme of management would prevent much improper cutting, 2695–6. A State demonstration area, serving as an object lesson, would be of use, 2698–9. Foresters hold diverse views as to the applicability of Continental methods in this country, 2700–2. We could grow better timber than is now imported, 2703. A poorer quality is now imported than formerly, 2703. Natural regeneration is impossible with ground game, 2708–14. The Blackwood at Rannoch is badly managed ; there are a few fine specimens where the wood was originally dense, and there is some natural regeneration, 2710–4. Few foresters can measure timber accurately, 2714–7 ; or tell the cubic contents of an area, 2720–1. Witness does not believe in under planting, but does not object to mixing trees, 2707, 2722–3. Conifers do well in Perthshire, 2724. If woods were mortgaged, and a regular plan of felling were a condition of the loan, it would be impossible to cut woods before the proper time, 2725–6.

Appendix XI.—Profits on woods, necessity of education, ground game, cost of planting, sporting value of land.

PITWOOD.—Margerison, 82, 137–44, 168–9 ; Glanusk, 1383, 1393, 1445–53 ; Schlich, 2434 ; Drummond, 2472–3, 2498, 2518–24, 2563–6 ; Pitcaithley, 2641, 2672, 2694–6 ; Croxford, 2745, 2762 ; App. I., III., X.

PLANTING, cost of.—Ramsden, 618–21 ; Glanusk, 1382–90, 1421–6, 1480–3, 1513–7, 1531–44, 1560 ; Robertson, 1834–45 ; Vernon, 2083–6 ; App. I., II. (ix.), IX., XI.

POST OFFICE, evidence on behalf of,—Roberts 3733–81 ; App. XVIII.

PRICES : (a) *Generally.*—Margerison, 166–7, 203–9, 271–6 ; Havelock, 949–50 ; Glanusk, 1393, 1449, 1509–12, 1535–7 ; Davidson, 2069–72 ; Vernon, 2207 ; Schlich, 2265–6 ; Drummond, 2469–70 ; Pitcaithley, 2641, 2672, 2694–6 ; Croxford, 2737–8, 2755–6 ; Roberts, 3778-81 ; App. I., II. (xi.).

(b) *Specific quotations.*—Margerison, 167 ; Havelock, 1049–50 ; Forbes, 1330–4 ; Vernon, 2081 ; Webster, 3272–3 ; Michie, 3356 ; Parry, 3643, 3661–2 ; App. VI., IX., X.

PROFITS : (a) *Generally.*—Bailey, 335, 366, 2782–5 ; Selborne, 570–5 ; Ramsden, 625–7 ; Slater, 748–9, 790–814 ; Havelock, 876, 883, 924–30, 979–80, 989–94 ; Glanusk, 1382–7, 1518, 1574–5, Robertson, 1772–3 ; Davidson, 1907–9, 2049 ; Vernon, 2081, 2107–9, 2126, 2164–76, 2214 ; Schlich, 2271–3, 2290, 2323–5, 2355–7 ; Drummond, 2516–7 ; Pitcaithley, 2633–7 ; App. I., II. (viii., ix.), V., VI., IX., X., XI., XXVII.

(b) *Improvement in value of estate.*—Havelock, 1047–8 ; Vernon, 2202–3 ; Craigie, 2943–4.

RABBITS.—Margerison, 263–7, 294–5 ; Selborne, 516–7, 549–51, 598–600 ; Ramsden, 693–8 ; Havelock, 884–9, 971–6, 1094–5, 1133, 1138–40 ; Forbes, 1295–7 ; Glanusk, 1383, 1402, 1538–9, 1578 ; Robertson, 1632, 1825–9 ; Vernon, 2186–9 ; Schlich, 2336* ; Pitcaithley, 2638–9 ; Parry, 3705–8 ; App. I., VII., XI.

RAILWAYS : (a) *Freight rates.*—Margerison, 18, 21, 137–44, 154–61, 189–94, 210–29, 244–6 ; Hopton, 328, 331 ; Havelock, 911–5 ; Robertson, 1651 ; Drummond, 2573–5 ; Croxford, 2738, 2751–4 ; Parry, 3702–4 ; App. I., III., IV., X.

(b) *Foreign, rebates.*—Hopton, 312–7.

(c) *Waggons, made of oak.*—Margerison, 185–8, 197–202 ; App. III.

RAMSDEN, Sir J. (Analysis of his Evidence).—Has planted large areas in Inverness-shire, 602–3, which should be profitable, 604–5. It is hard to find well-trained foresters, 606–7 ; the State should provide facilities for training owners and foresters, 608. Tithe is a heavy burden on plantations, 609–11. Is trying new conifers : the *Picea nobilis* and *Douglasii* do very well, 612–4. Some of his woods are many miles from a station, and the transport is a heavy item, so that he has left the thinnings on the ground, as it would cost more than their value to move them to the station, 615–7. His expenses of planting amount to about £2 12s. per acre, with another £1 for fencing, 618–21. It would be desirable to have a State model forest, if practicable, 622–4. The value of his plantations will be very great to those who come after him, 625–7. The salary of a forester is disproportionate to the capital value of the property he has to manage, 628–9. Education should make the woods more productive, 630–1. Forestry should be taught at the universities, 632–5. Rates and tithes are very heavy in proportion to the receipts, 636–40. It would be a relief if woodlands were treated as agricultural land under the Act of 1896, 641–2, 692 ; but to relieve woodlands would only increase the rates on other land, 641–2. It would be better to increase the salary of foresters if we could get really good men, 643–5. It is desirable to instruct owners and then the foresters, 646–8. There is not so much disease when larch is mixed with other trees, 651–8. His Buckinghamshire beech woods might have been more profitable had his men been sufficiently educated to mix larch with the beech, 658–62. Witness has no revenue from his old woods, and his 10,000 acres of new woods are now coming to the time when they will want thinning, an operation requiring proper management, 663–72. More capable foresters are wanted, 673–7. The underwood from the Bucks woods is hardly saleable, but witness does not know how to render the woods more profitable, 678–86. Witness has not succeeded in getting his assessments to local rates reduced, 687–8. The tithe on his woods is highest where the land has long been under wood, 689–91. Rabbits are incompatible with profitable forestry, 693–4. In letting land for shooting, witness reserves the right to destroy hares, rabbits, roe-deer, and squirrels, which are all mischievous, 695–8. Witness always sends his manager for any information to Mr. Grant-Thomson, 673–6, 699–702. It would take a man a long time to learn much by visiting other woods in England, 699–705. It would be a great advantage to have a State model forest where a young man could go for training for a year or so, 706–9. The land planted in Inverness-shire was previously partly under deer and partly under sheep, worth not more than 2s. per acre, 710–17. It varies in altitude from 800 to 2,000 feet, but witness only plants for shelter above 1,500 feet, 718. The wages for managing agricultural land are much higher than for woodland, whereas on the Continent managers of forests are as highly trained as any land managers, 719–24. The rent of sheep farms has almost reached the vanishing point, 725–33. Owners of such land generally have no money for planting, 734–5 ; the State could buy land cheaply for afforestation in the Highlands now, 736. Witness does not find that his forester's operations are interfered with by the gamekeeper, 737–8.

Rates, local.– Margerison, 301 ; Bailey, 403 ; Selborne, 546–8, 590 ; Ramsden, 609–11, 636–40, 687–8 ; Havelock, 902–4, 936–42, 994–1006, 1105, 1109–12 ; Glanusk, 1404 ; Vernon, 2090–1, 2102–5, 2127–34 ; Drummond, 2480–3, 2500–2 ; Croxford, 2775–9 ; Maxwell, 2831–86 ; Minchin, 3156–9 ; App. I., IX., X., XII., XIX.

Railway rates, see under *Railways* (*a*).

Regeneration, natural.—Bailey, 393–5 ; Havelock, 1119–21 ; Vernon, 2076–80, 2173–6, 2232–5, 2255–6 ; Pitcaithley, 2708–14 ; Michie, 3394, 3469–70.

Rent above which it is not profitable to plant land.—Margerison, 44 ; Glanusk, 1508, 1576–80 ; Robertson, 1787–94 ; Vernon, 2179–81, 2215–6 ; Schlich, 2267, 2326–30, 2412–8 ; Drummond, 2628–9 ; Pitcaithley, 2661, 2704–5 ; Somerville, 3130 ; Michie, 3396–9 ; Parry, 3659–60 ; App. I., XI.

Roads in woods.—Margerison, 22–4, 45–8 ; Havelock, 899, 905–7, 943–5 ; Robertson, 1638 ; Schlich, 2324, 2377.

Roberts, M. F. (Analysis of his Evidence).—Assistant Engineer-in-Chief to the Post Office, 3733. English oak is superior to foreign as regards strength when subjected to torsional and splitting strain, 3734, 3751–6. Cannot speak as to durability, 3734, 3751, 3776–7. Baltic fir is more durable and better than British for telegraph poles, 3735–9. Cannot get long poles of British timber, 3736–8. Larch will not take creosote like fir, 3740–1, 3767–75. Some poles creosoted in 1870 are still in fairly good condition, 3741, 3749–50. Iron rods are sometimes substituted for wooden telegraph poles in towns only, 3742. Norwegian, Swedish, and Finnish red pine is used for telegraph poles, not Baltic white wood, 3743–5. North German timber is not so suitable, it is not so straight, and has less taper, 3745–8. English oak is more slowly grown, 3754–6. It is getting more difficult to get timber for telegraph poles, 3757–8 ; and the cost is rapidly increasing, 3778–81. Practically no home-grown timber is used for poles, the Post Office cannot get quotations, 3760–6.

Appendix XVIII. Post Office tests of timber for telegraph poles and cross-arms.

Robertson, D. (Analysis of his Evidence.)—Represents the Royal Scottish Arboricultural Society, 1581, 1849–62 ; is forester to the Duke of Sutherland at Dunrobin, 1582. Would have been glad to have had a training such as is given abroad, 1583–5, 1644. A State experimental forest is much needed, 1586, 1677–9, 1689, 1859. A practical training should be combined with theoretical instruction, 1587–8, 1734–41. All classes need instruction, 1589–92. Is in favour of State forests, 1593. There is much waste land which might advantageously be afforested, 1594–5, 1686–8. There is not much to be learnt from the Crown woods in England, 1596–7. A State demonstration area should be so chosen as to give as much variety as possible of soil, level, etc., 1598–1604, 1781–3. Skibo would be a very good site, 1600, 1782–3. Foresters generally have not much knowledge of the removal and utilisation of forest products, .1605–11. There is considerable expenditure on labour in woods, quite 20s. per acre per annum, 1612–4, 1667–72, 1818–9, 1895. The area and quality of wood are decreasing in Scotland, 1615–6, 1654–60, 1767–70. Trees can be raised cheaply in home nurseries, 1617–21. Many of the new conifers grow well in the Highlands, 1622–4. The cost of fencing ought not to be put down to the plantations, 1625–6. The cost of an ordinary 6-wire fence is about 5d. per yard, 1625–31, 1830–3 ; fencing against rabbits adds about 3d. a yard, 1632, 1825–9. A considerable area might be planted without interfering with the sporting rents, 1633. Timber is often sold too early because the owners want the money, 1634–7. The woods in the North are generally well laid out for removing the timber, 1638. The saw milling machinery might be improved if the areas under wood were larger, 1640. The continental methods of growing timber should be demonstrated, 1641–4. An object-lesson is what is wanted, 1644–5, 1689–92. The forester has not as a rule a sufficiently free hand, 1646–7. Squirrels do a great deal of damage in the north of Scotland, 1648–50. Railway rates are high, 1651. For short distances traction engines would probably be profitable, 1652–3. There is a desire for improvement among foresters, 1645, 1661–4. We can grow as good timber here as in Germany, 1665. A State demonstration area should be in Scotland, 1666. Woods give employment to clogmakers, bobbin mills, and such small industries in their neighbourhood, 1669–72. The Scottish Arboricultural Society's excursion to Germany created great interest in forestry, 1662, 1673–7. On many Scotch estates the factor, who may have no knowledge of forestry, has most influence over the woods, 1680–1, 1693–1700. Timber supplies from abroad will probably diminish, as the quality is falling off, and prices may probably rise, 1682–5. On many estates there is great irregularity in the quantities cut, 1700–5 ; this irregularity in the supply does not have much effect on the timber market, 1706–7. Timber merchants prefer to make arrangements for large quantities abroad, 1708–9. The quality is a more important factor in the price, 1709–10. A regular annual supply of timber would reduce the expenses, 1711–4. A thorough training is required to make proper working plans for a number of years ahead, 1715–7. Forest schools are required for training foresters, 1718–21, 1727–33. Witness got all his training and knowledge in the woods, 1721–6. The State demonstration area might be in connection with Edinburgh University, 1738–44 ; and should be under a thoroughly competent forester, 1742–4. The waste lands that are suitable for planting do not bring more than 1s. to 2s. 6d. per acre to the owner, 1745–8. The chief fault in management is over-thinning, 1637, 1749–51. On many estates timber is cut when money is required, there is no system, and no definite age is fixed beforehand, and at the end there is often left not more than a quarter crop of poor quality, 1752–7, 1764–6 ; a thousand acres in Inverness-shire fetched only £11 per acre ; the stock was thin on the ground and rough in quality, 1637, 1846–8. In thinning the best trees are often taken out instead of the worst, 1757–61. Vacancies in young plantations are often not filled up, 1762–3. The present system of managing woods is not profitable, 1771. Financial returns of woods as managed generally in the North of Scotland are no guide to what profits could be made, 1772–3. No special precautions are taken to prevent loss by blown trees, 1774–7. A landowner could put much of his land under systematic management without interfering with the beauty of his park, 1778–80. Land should not be planted if worth 5s. per acre for other purposes, 1787–8. Land that is not suited for cultivation will grow very good timber, 1789–94. The late Duke of Sutherland tried steam-ploughing, but only for agricultural purposes, 1795–7. Larch disease is decreasing in Scotland, 1798–1802. Larch grown from imported seed is less liable to blister, 1802. The new larches are very fast growers, 1803–6. Sheep farming is unprofitable in the Highlands now, 1807–9. Many Highland hills will only keep one sheep on five acres, 1810–3; sheep land is rented at about 6d. per acre, 1814–5. One shepherd could look after about 500 sheep, 1816–7; so that sheep-farming employs about one man on every 2,500 acres, 1817, 1823–5; whereas one man can look after about 100 acres of forest, 1818–25. Planting can generally be done for 25s. to 30s. per acre, 1834–5. A man can plant about 1,000 three-year-old plants per day, 1837–45. The planting iron is not used in the north, 1844–5. Forestry is much neglected, 1851–2. The Scottish Arboricultural Society has greatly increased the interest in forestry of late years, 1855–6. There should be State aid for forestry education, 1853–4. A forestry school, with cheap education, is desirable, 1860–5. Afforestation of land in the Highlands is a Government question, 1866–7, 1871, 1896; private owners will not do much for pecuniary reasons, 1868–70. Proprietors in the Highlands think that there is a likelihood of the Government stepping in, and do not therefore like to invest money, 1868. Experts should decide what land is suitable for afforestation, 1872–7. On a sheep farm of 14,000 acres in Ross-shire, with 4,000 acres of wood, there were about half-a-dozen shepherds, while the men employed on the timber portion ran from 100 to 200, 1878–84. Not many foresters' sons follow their fathers' profession, 1885. Elementary knowledge connected with forestry might be taught in primary schools in certain districts, 1886–7. Young men intending to be foresters should work on a Government area with a forest school, 1888–93; owners and factors should attend Universtity classes with expeditions to the experimental areas, 1891–2. Owners and factors should be instructed in the first place, 1892–4.

Roumania, timber supplies.—App. II. (xi.).

Russia, (a) *Imports from.*—Roberts, 3743–5.

(b) *Legislation.*—App. XXV., XXVI.

(c) *Timber supplies.*—Schlich, 2259; App. II. (xi.), (xiii.).

Salaries of foresters and woodmen.—Margerison, 133; Bailey, 405, 461–7; Ramsden, 628–9, 643–5, 719–24; Havelock, 1051–2, 1126; Forbes, 1349–51; Glanusk, 1436–40; Schlich, 2396–400; Somerville, 3123–5; Webster, 3195–6, 3201, 3263–8; Michie, 3331, 3377–9; App. VII.

Sawmills.—Margerison, 25, 226, 305–8; Havelock, 879–80; Robertson, 1640; Croxford, 2740–1; Parry, 3643.

Saxony.—Schlich, 2271–3; App. XXV., XXVI., XXVII.

Schlich, Prof. W.—Has been Inspector-General of Forests in India, and is principal Professor of Forestry at Coopers Hill, 2257. The excess of imports into Europe over exports is 2,600,000 tons, 2258. The net imports into the British Empire amount to about £17,850,000 annually, 2258; and into the United Kingdom alone to over £22,000,000, 2258; and these quantities have been rapidly increasing, 2258–60. The principal exporting colony is Canada, 2258. In Germany, imports are also rapidly increasing, and Germany, in 1899, imported 4,600,000 tons, mostly from Austria-Hungary and Russia, 2259. Germany will be a great competitor with England for Baltic timber, 2259. Austria-Hungary will not be able to continue to export at the rate it has done lately, 2259; the stock in Hungarian forests is 30 per cent. below the normal, 2259. The average consumption of timber in the United Kingdom is 14, in Germany 18, cubic feet per head per annum, 2259. Austria only produces 19 cubic feet per annum, so that when its industries are better developed it will require all its own production, 2259. In Russia, only 25 per cent. of the country has more forests than are required for home consumption, and 50 per cent. has less than it requires, 2259. Many merchants can now get better prices by selling the Russian timber within the country instead of exporting it to Germany, 2259. More timber is consumed per head of the population in the United Kingdom than 20 years ago, 2260. Of the total imports into this country, coniferous timber forms 87 per cent., 2262. The only large sources of supply of such timber are the countries round the Baltic and North America, 2262. China will require all it can produce, and in Argentina the difficulties of getting the timber out are too great at present, 2262. In spite of the considerable net export from the United States, that country consumes 33 per cent. more timber than the annual growth, 2262. Canada now exports as much to the United States as to the United Kingdom, 2262. During the last 30 years the exports from Canada have been stationary, 2262. If Canada introduced rational management of her forests, converting 10 per cent. of them into permanent forests, it could probably supply the whole world with coniferous timber, 2262. There are 800,000,000 acres of forest land in Canada, of which one-third are timber forests, 2262. There are no other sources of coniferous timber worth mentioning besides Canada and the Baltic countries, and there will be a shortage unless the Canadian woods are put in order, 2263–4. There is no probability of an immediate scarcity of hard woods, 2263. Degrees in forestry are given at three universities in the United States, and simpler instruction is given at 40 other colleges, 2263. The price of timber fell from 1870 to about 1886, but has been rising since 1894, 2265–6. There is a considerable field for afforestation in this country, 2267, 2360. There are 9,000,000 acres of waste land in Great Britain, besides the mountain and heath land used for grazing, amounting to another 12½ millions, or 21 millions altogether, 2267–9, 2358–9. The State might acquire areas for afforestation, 2269, 2293–4, 2302–7, 2361. There are 770,000 acres in counties within 50 miles of London unaccounted for in the Agricultural Returns, 2267–9. A committee of experts should be appointed to ascertain what portions of these areas could be made available for afforestation, 2270, 2299–304, 2361, 2451. Estimates of financial returns from woods in this country are generally untrustworthy, 2271, 2323–5, because the areas are not fully productive, 2271, 2323, and because other accounts are mixed up with them, which ought not to be charged to the forests, such as unnecessary roads and fences, 2271, 2324. As an example of what can be done, the forests in Saxony, which have been carefully managed since 1811–1831, show an increase since then in area from 354,000 to 412,000 acres, in production from 41 to 69 cubic feet per acre, in net receipts from 4s. to 18·4s. per acre, while the stock of standing timber increased from 2,128 to 2,618 cubic feet per acre, and the price from 2·04 to 4·68d. per cubic foot, 2271–3. One forest on average soil in the Anthonsthal range yields a net profit of 38s. per acre per annum, 2273. Forests can be grown at high altitudes when the productive powers of the soil are preserved; there may be difficulty at starting in this country because the soil in the areas which were formerly under wood have deteriorated through climatic influences, 2273, 2378. Education is required for various classes, 2274. For higher education there should be a faculty of forestry at one English university to begin with (Oxford or Cambridge) and one Scotch university, where a complete training could be given, 2274, 2439–47. Trained experts are wanted not only for this country but also the Colonies, which at present borrow men from the Indian Government, 2274. Proprietors should have the opportunity of learning the principles of sylviculture at the

university, 2274. Those intending to take up estate agency after leaving the university should also learn forestry as well as agriculture, 2274, 2440. For the higher education in forestry an estate of sufficient size within reasonable distance of the university, to be used as a teaching forest is necessary, 2274, 2280, 2314–7, 2381–3. Until one is acquired use might be made of instructive patches in woods on private estates, for instance, the Duke of Bedford's estates near Oxford and Cambridge, 2274, 2277. Students should also make excursions to the Continent until we have such areas, 2274. The Duke of Bedford's woods are under a working plan prepared by witness, 2274. The lower foresters should be trained in instruction forests, which should have a competent manager, 2274, 2315–7, 2406–8. The men would come to work in the forest and receive just sufficient pay for their food and keep, 2274, 2406–8. The manager should be competent to give all the practical and elementary theoretical instruction, 2274. As regards the intermediate positions of ordinary estate agents, provision ought to be made at the agricultural colleges for lectures and visits to instruction forests, 2274, 2355, 2448–50. Distinguished apprentices trained under the lower course should be given facilities to attend the courses at the agricultural colleges, 2274, 2409. Either Cambridge or Oxford would be a good centre for England, 2274–8, 2282–6, 2353, 2444–7. Many woods in the Chiltern Hills are probably more accessible from Oxford, 2277. In England one of the Crown woods might be made available, 2279, 2283–4. Witness would prefer several instruction areas, 2280–1. There should be an area in England and one in Scotland, connected with the university, 2287–8. Coopers Hill only trains students for India, 2290. The Indian Forest Department has about 20 million acres to manage, there are 200 English and 11,000 native officials, 2290. The forests in India have enormously improved in the last 40 years, and the net revenue from them has increased from 16 to 100 lakhs, 2290, 2355–7. The forest branch of Coopers Hill was established in 1885, and a fourth of the students at the college are forest students, 2290. Indian forest students undergo an entrance examination, and are then taught forestry, with cognate sciences, for two years, with excursions in the neighbourhood, and for 15 days to Normandy ; in the third year they go to Germany to study for eight months at one centre, followed by a six-week's excursion chiefly through Germany, 2290. The Coopers Hill course is as good as it can be under the circumstances, 2291 ; but the student has not the advantages of rubbing against other people as at a university, 2291 ; and the teaching of the cognate sciences is arranged to suit the engineering rather than the forestry students, 2291. The woods near Coopers Hill are good for the study of forest botany, 2291–2. The Commissioners of Woods and Forests are putting some of the State woods under working plans, but other considerations are also involved, 2293. More might be done in the New Forest, and the Commissioners ought to face the outcry which would be raised if it was put under systematic management, 2293. The State might acquire forests as opportunity offers, which might be made available as instruction forests, 2293–4, 2310–3. Private effort should be stimulated chiefly by education, 2295, 2331, 2346–7, 2381–3. Landed proprietors should also form associations to assist in having centres of instruction, 2295. Loans might be made, on which interest should not be paid until the returns begin to come in, and which should then be paid off rapidly, 2295. There should be a Government expert always available to give advice and inspect woods, 2296, 2425–7. There should be at least one fully trained local assistant at each of the Crown forests, 2296–8. Some Corporations which have bought land for their water supply have also acquired the grazing rights, 2269, 2308. Caution must be exercised in the State purchasing land, so as not to bring heavy pressure upon the population, or where the difficulties are considerable, 2308–12. Retired Indian forest officers might be put in charge of these instruction forests, 2317 ; or the forest might be managed by the University professor, 2320, 2402–4. These forests should be managed so as to yield the highest possible profit, 2318–9, 2405. The Commissioners of Woods and Forests can only control 16,000 out of a total of 63,000 acres in the New Forest, 2321–2. Land used for agricultural purposes should not be diverted to forestry, 2267, 2326–30. No general statement can be made as to the altitude up to which land may be planted, 2328 ; nor as to the rental below which it would be profitable to plant, 2329. Whether land is suitable for planting depends upon local conditions, 2328–30. There cannot be a large proportion of State forests in this country under present conditions, 2331, 2369. Some of the Irish Congested Districts Board's attempts to afforest land have failed through lack of knowledge of forestry, 2330–5. The plantations at Knockboy failed because the trees were planted on the wrong side of the hill, exposed to gales and salt spray, and owing to the boggy nature of the ground, 2333–6 Boggy ground cannot be successfully planted if the bog is more than 1½ yards deep, unless drained, 2333.* The unfavourable results in Ireland are not evidence against State afforestation, 2334–6 ; they are an argument of the necessity of trained experts, 2335–6. Red deer do much damage in Germany, and rabbits are increasing, 2336.* Land is not more uniform in Germany than in England, 2337–44. There is an increased interest in forestry in late years, 2345. There should be class rooms at the model forest, 2350–2. It is important that the sons of landowners should have some forestry education, 2354. There is probably a larger area available for planting in Scotland than in Wales, 2362. The State forests which are likely to be established should be used for the collection of data, and serve as model forests under different circumstances, 2363–4. State forests could be made remunerative, 2365–7. State forests should only be acquired in Great Britain to serve as training grounds or the collection of data, 2366–9. Woods in this country do not produce as much as they ought owing to errors of sylviculture and of management, 2370–6. With such scattered work it is not possible to make full use of mechanical means of transport, etc., 2376–7. The advantages of good roads are often overlooked, 2377. Our soil and climate are as suitable as those of Germany, 2378–9. The soil is not exhausted by growing woods, but woods, in their natural state, go on for ever, 2378–80. Some people do not replant because of the insects but in Saxony the insects are trapped and got rid of, 2379. A demonstration forest would be useful for teaching some things from the very beginning, 2384–6. County Council lectures would be very useful, 2387–8. The demonstration areas should be State or Corporation, to ensure continuity of management, 2389–91. Artistic beauty of forests can be combined with economical management, 2392. The extension of the forest area would be valuable to agriculture, 2393–4. The labour question is also important, 2395. The salary of foresters is low considering the capital value of the stock they have charge of, 2396–2401. Estates with large areas of wood ought to be in charge of one or more men who have had a thorough training during several years, and in receipt of large salaries, 2397–9. The State demonstration area should be at least 2,000 acres, 2410–1. Strong plough land which went out of cultivation 20 years ago should have been planted, 2412–8. Land which provides food should not be taken out of cultivation ; cheap corn will not always come from America, and prices of grain will rise again, 2417–20. Landowners, in planting timber, are planting a crop which will probably increase in value in view of the probable shortage of timber, 2421–4, 2433. It is difficult to recommend particular trees to grow ; probably larch, Douglas fir, and ash are as profitable as any, 2428–32. As good pitwood can be grown here as on the Continent, 2434. Coniferous timber with large rings is generally assumed to be less substantial than when grown close, with narrow rings ; with broad leaved trees it is the other way round, broad rings probably indicating better quality, 2434–6. Larch, planted with beech, is less liable to disease, 2436–8. Forestry must not be attached to a chair of agriculture or botany, 2441–3. University students should go abroad, for part of their practical course, as at Coopers Hill, until we have the necessary demonstration forests in this country, 2452.

Appendix II. (xi.).—The outlook of the World's timber supply ; area of forests in Europe ; imports and exports of European countries ; imports into United Kingdom ; timber supplies of Germany, France, Belgium ; consumption in different countries ; timber

industry of Roumania, Norway, Sweden, Russia; supplies of non-European countries, United States, Canada; timber supplies of British Empire.

SCHOLARSHIPS, see under *Education (f)*.

SCOTS FIR, see under *Pine*.

SCHWAPPACH, Dr. A.—Report on a visit to the forests of Scotland: Condition of woods in Scotland; mismanagement; afforestation of waste land; profits and expenses; economic importance of forests; British arboriculture; suitability of climate, etc.; recommendations as to sylvicultural management; App. II. (ix.)

Information as to the assistance that foreign States give to planters, and the encouragement they offer to the afforestation of waste lands: State assistance by various forms of instruction and inspection; pecuniary assistance by payment of part of the cost of planting or premiums; credit institutions; remission of taxation; distribution of plants or seeds; co-operative societies; seed control stations; State officials permitted to manage or give advice concerning the management of private woods; advisory experts attached to chambers of agriculture and similar societies; work performed by the Brandenburg Chamber of Agriculture, App. XXV.

Review of the restrictions, in the public interest, that States place upon individuals owning forests: Legislation concerning protective and non-protective forests; mountain slopes and sand dunes; prohibition of deforestation; requirement to afforest; regulations for the prevention of mismanagement; prescriptions requiring certain methods of management; State requirements concerning the training of foresters employed in private woodlands; compulsory afforestation; State supervision over private forests; App. XXVI.

SEASONING of timber, artificial.—Croxford, 2749–50.

SEEDS, distribution of, and seed control stations abroad; App. XXV.

SELBORNE, EARL OF. (Analysis of his Evidence).—Has had a working plan prepared for the woods on his estate by Mr. Nisbet, and manages them on a regular system, 508–10, 525–30, 568–70. Forestry is of great importance to landowners, and timber will be more valuable in future, 510*. Much agricultural land could be profitably put under timber, 511–3. All classes stand in need of education, but owners should be instructed first, 514–6. Rabbits and forestry are incompatible, 516–7, 549–51. Mice also do much damage, and are encouraged by the destruction of weasels, hawks, and stoats, 517, 549–50. The man who does not keep ground game has to protect his estate against those who do, 518; and it would be reasonable that he should claim the fencing off of rabbits, 531–2. Instruction in forestry should be provided at the universities, 520–4; landowners would not abandon their university course to attend for a couple of years at a special school, 521–2. The man who carries out a working plan prepared by an expert need not necessarily have an extensive knowledge of forestry, when the woods are visited periodically by the expert, 525–30. The men who work in the woods are ignorant of many operations in forestry, 533–4. There is a little shortage of labour, but landowners would be willing to pay a little more for good woodmen, 535–7. Witness has planted chiefly conifers, 538–40; he has given up pure larch plantations because of the larch disease, 541–2; which was introduced through injudicious cutting of branches, 542–6. It would be a great help to be relieved of rates, 546–8. Game, apart from rabbits and hares, do no damage, 549–53. Mr. Nisbet inspects the woods every year, 525–7, 554–8; the work is being better carried out than it was at first, 557–60. Witness's woods contained a great deal of copse, but the value of the underwood is not a fifth of what it was, and he proposes to grow more timber, 561. The crops are not yet sufficiently dense to require thinning, 562–3. It would be a good thing if there were a State demonstration forest, such a forest being part of the forestry school, 564–7. The area of witness's woods is about 400 acres, 568–70; and he has found a working plan useful even for so small an area, 570. Witness's woods are already beginning to yield a little more income than before, 570–5. If a faculty of forestry were started at the universities, the lecturer should also give a condensed course, suited to those who may have to manage woods, 576–8. It is of more importance to educate the owners and agents in the first place, 578–80. His bailiff would not be able to carry out the working plan without Mr. Nisbet's annual visit and witness's own supervision, 581–6. State afforestation of waste areas would be a good thing, 587–8. A complete scheme of education would be a State model forest in connection with the universities, 589. Cannot say that tithes, rates, and death duties are a real bar to plantations, 590. The continental woods are not less beautiful than English, 591–2. Forests help to maintain the population on the land, 593. Experiments should be carried on in connection with model forests, 595. Japanese larch is not entirely immune from disease, 595–7. The timber of Japanese larch will probably be as good here as in Japan, 597–8. Rabbits do not touch the Corsican pine, 598–600.

SELECT COMMITTEE of 1885–7, summary of evidence.—App. I.

SEIMECZBANYA.—Bailey, 454–7, App. II. (ii.).

SETTLED LAND ACTS.—Craigie, 2920.

SHAKE.—Margerison, 251–5, 261, 292–3.

SHEEP: (*a*) *Farming* (see also *Grazing rights*).—Ramsden, 710–7, 725–35; Slater, 750–4; Glanusk, 1408–10, 1561–4; Robertson, 1807–25; 1878–84; Davidson, 2004–20; Drummond, 2505; Webster, 3216–7, 3241–3; Michie, 3421–37; Parry, 3668–72, 3680–5, 3700.

(*b*) *Injury by*.—Glanusk, 1561–2, 1572–3; Vernon, 2188; Drummond, 2514–5; Michie, 3394; App. I.

SHELTER: (*a*) *belts to protect woods*.—Margerison, 38; Bailey, 373, 390–402; Robertson, 1774–7; Webster, 3258–60: App. I.

(*b*) *For farming*.—Ramsden, 718; Havelock, 1106–12; Davidson, 1921, 2054–7; Drummond, 2517, 2591, 2599–603; Webster, 3213, 3241–3; Parry, 3688–9; App. XXVI.

SILVER FIR.—Bailey, 339–402.

SLATER, A. (Analysis of his Evidence.)—Is land steward at Osborne, and has had experience in Scotland, 740–1. A model forest with a school in connection is required, 742–6, 826–7. British woodlands are not in a satisfactory condition, 747; but with improved methods forestry would be very profitable, 748–9. There is much waste land and sheep farms which could be profitably afforested, 750–4. Foresters are, as a rule, anxious for instruction, 755; they generally know their practical work, but not the scientific part, 756–62 768–72. A State model forest should illustrate all operations, 763–5. Planting is not carried on to a great extent, 766. Owners and agents do not know much about the practical working of their woods, 767. Foresters should have a training in woods, and then spend, say, a couple of years at a school; this would be preferable to training them, while working as employés, in the State model forest, 771–81. Students cannot get practical training at the Botanic Garden, Edinburgh, because there are no woods, 742, 782, 857–8. Owners and agents should be instructed in the principles of sylviculture, and foresters in these and the practice also, 783–9, 847–56. A mixed plantation of 40 acres of larch and fir, on land not otherwise worth more than 1s. an acre, has returned 7s. per acre after allowing for expenses and calculating interest at 3 per cent., 790–803. If interest had been taken at 2½ per cent., at which Government can borrow nowadays, the profit would have been much greater, 804–14; so that it would pay the State to invest money in such land, 811–14. The desire for instruction among foresters has greatly extended during the past few years, 815–20; the excursions abroad made by the arboricultural societies have greatly contributed to this feeling, 821–5. Owners are interested, but have not much knowledge of the subject, 828–31. There is no scarcity of labour, 832–37. The larch sold by witness fetched 1s. per foot, the spruce less, 838–40. Witness has taken a great interest in forestry education, 841–3. The State should provide opportunities for education, 844–6. The example of an area of poor land of which the value has been increased by planting is within an hour of Edinburgh, 859–61. A school should be on the forest area and close to Edinburgh, 862–4. Witness cannot speak as to loans for planting, 865–69. Foresters do not generally understand thinning, 870–1. Woods should be managed upon a working plan, 872–3. A model forest would also serve for conducting experiments in forestry, 874.

Appendix V.—Example showing the outcome of 40 acres of mixed larch and fir woods at the end of the 75th year.

Slides.—Margerison, 151–3.

Somerville, Dr. W. (Analysis of his Evidence.)—Assistant Secretary to the Board of Agriculture, formerly Professor of Agriculture at Durham and Cambridge, 2994. Is President of the English Arboricultural Society, 2987. Agrees with the schemes of education recommended by Col. Bailey and Dr. Schlich, 2990, 3041. Local lectures and local instruction have also certain advantages, as has been done in Northumberland and Aberdeenshire, 2990–2, 3049–50, 3054, 3099–113, 3133–6. The lectures given during the less busy months at Hexham attract the working foresters, and also men employed in nurseries, 2990–1, 2996, 3006–7, 3105–10. The Northumberland and Durham County Councils gave scholarships sufficient to pay the travelling expenses of those attending such lectures, 2991, 3009, 3012–7. These lectures, both at Hexham, and at the college at Newcastle, were well attended, by about 20 to 30 students, 2991, 3005–8, 3104. County councils should also start forestry demonstration plots on the experimental farms attached to the agricultural colleges, as has been done by Northumberland, 2992–3, 3016, 3055. Forestry is required for the B.Sc. in the Department of Agriculture at Durham University, 2994, 3056. Lectures on forestry are given at Cambridge, but it is a voluntary subject there, 2994–5, 3057–9; the lectures at Cambridge were much appreciated, the class numbering 12 to 15, 2994–5, 3018–22. The lectures at Cambridge were largely attended by the landowning class, while at Hexham they were chiefly working foresters, 2994–7, 3072. The landowners stand first in need of education, and they can be attracted by providing instruction at the universities, 2998–9, 3072, 3126–9. There are few good woods near Cambridge, 3000, 3023–4, 3069; but the students there could make tours abroad, 3001. A considerable extension of the forest area could be profitably made, 3002, 3063; but improvement would best result from training the private owner, 3003–4. Prejudice in regard to agricultural education has been overcome in recent years; but in forestry there is no prejudice to overcome; the present condition of forestry is due to the ignorance of the landowner, 3025–37. There are experts who give advice, and an increase in their numbers would be desirable, 3038–40. The forester wants instruction rather as to diseases of trees, principles of tree growth, and methods of planting and felling, etc., the landowner rather in the economics of the subject, 3042–4, 3138–9. The annual expenses of the forest school would be about £600 to £700 a year; it could be run by two special men, one teaching sylviculture and mensuration, the other teaching the underlying natural sciences, 3045. The instruction forest must be worked so as to be a financial success, 3046–7, 3139–41. A small portion of the area would form an experimental ground, not intended to give financial success, 3047–8; and its accounts should be kept quite separate, 3140–1. The number of men capable of giving instruction is limited, but they are increasing, 3051–3. There are text-books in forestry, but witness does not know of an elementary primer, 3060–2. Foresters can obtain the transactions of the arboricultural societies, 3060–1. An expert committee to determine what areas might with advantage be planted would furnish valuable information, 3064–5. The course given by witness at the Durham College of Science reviewed the whole subject in about 30 hours' instruction, with excursions, 3066–9. At Cambridge in 30 hours' instruction he had not to teach forest botany and entomology, 3070–1. Students at Cambridge have other subjects to learn, and we should aim at giving a 50 hours' course annually in forestry proper to begin with, 3072–4. Those who want to specialise ought to go to Coopers Hill, 3075. The number of qualified instructors required by county councils need not be large, if they lecture in several counties by making suitable arrangements, 3076–8, 3111–3. There is plenty of suitable land, worth not more than 5s. per acre, for a demonstration forest near Cambridge, 3079–81; but the tithe would be a heavy burden, 3081–5. Apart from larch disease, insects do far more damage than fungi, 3086–9; so that the study of entomology is quite as important as that of fungi, 3090. The number of dangerous fungi is something under half a dozen, 3091; the corresponding number of insects is not much more than six, 3092–6; many injurious insects do not attack healthy trees, 3096. Injurious insects can be much more easily checked than fungi, 3097–8. A suitable course for county councils would be one evening lecture for 20 weeks, 3099. The lectures at Hexham were given in the evening, 3100. There should be permanent centres of instruction at Edinburgh and Aberdeen, 3114–5. There are men available to give instruction, who have gone through a course in this country, and subsequently taken a complete course on the continent, 3053, 3116–9. Forestry plots on the experimental farms of agricultural colleges should be under the charge of a competent person, 3120–2. The salaries of foresters are low in proportion to the interests committed to their charge, 3123; and when landowners are educated to realise the value of their woods, these salaries might be on a higher scale, 3124–5. This does not mean that the estate would be weighted with heavier charges, 3125. On poor land timber pays better than crops, 3130. There is not room for the very small holder in the production of timber, 3131. Bird destruction has not materially increased damage by insects, 3132.

Spain, education.—App. I.

Sparks.—Margerison, 38; Bailey, 373.

Sport (see also *Game*).—Davidson, 2014–5, Craigie, 2947–53; App. II. (ix.); rating of, App. XIX.

Spruce.—Drummond, 2497, 2525–30, 2560–4; Croxford, 2738, 2745–8, 2760–4; Roberts, 3744–5; Webster, 3280; App. IX., X., XI.

Squirrels.—Ramsden, 695–8; Glanusk, 1402–3; Robertson, 1648–50.

State Afforestation, see *Afforestation*.

Stoats.—Margerison, 300–1; Selborne, 517, 549–50.

Succession Duties, see *Death Duties*.

Surveyors' Institution.—App. I.

Sweden: (*a*) *Imports from*.—Vernon, 2206; Roberts, 3743–5.
(*b*) *Supplies of timber*.—App. II. (xi.).

Swine.—Vernon, 2188.

Switzerland, legislation.—App. XXVI.

Sycamore, prices.—App. VI., X.

Taxation, remission of, in foreign countries.—App. XXV.
See *Death Duties*, *Rates*, and *Tithes*.

Telegraph Poles and arms.—Roberts, 3733—81; App. XVIII.

Thinning.—Margerison, 63–4; Bailey, 335, 386; Selborne, 562–4; Ramsden, 615–7, 672; Slater, 870–1; Havelock, 1093; Forbes, 1370; Robertson, 1757–61; Pitcaithley, 2691–7; App. I., II. (ix.), VII.

Thiselton-Dyer, Sir W. T.—Diminution of world's supplies of timber; necessity of educating competent men for the Colonies; training of students for the Indian Forest Service, App. XX.

Timber: (a) *Preparation* (see also *Creosoting*).—Margerison, 18, 111–21, 210–29, 244; Drummond, 2499; Croxford, 2738–9, 2743, 2751–4; Parry, 3643, 3663–4, 3713–4, App. III.

(b) *Prices, see Prices.*

(c) *Production, consumption, and supplies.*—Schlich, 2258–64; App. II. (xi.).

(d) *Probable scarcity.*—Margerison, 53–5, 124; Bailey, 335, 371–2, 408–14, 441–2; Selborne, 510*; Robertson, 1682–5; Davidson, 2066–72; Vernon, 2160–1, 2200–1; Schlich, 2258–66, 2421–4, 2433; Croxford, 2734–5, 2757–9, 2767, 2772, 2780–1; Webster, 3188; Michie, 3315, 3354–7; App. I., II., (viii., x., xi., xii.), XX.

(e) *Quality.*—Margerison, 3–9, 40, 69–73, 93–108, 185–8, 197–202, 239–43; Hopton, 325–9; Bailey, 335, 371, 437–45; Havelock, 881–2; Robertson, 1665; Schlich, 2434–6; Pitcaithley, 2703; Croxford, 2730–35, 2747–50, 2755–6; Webster, 3203–4; Michie, 3438–47, 3452–4; Roberts, 3734–66; App. I., III., XVIII.

(f) *Regularity of Supply.*—Margerison, 15–8; Bailey, 335, 396–8; Havelock, 1063; Robertson. 1700–9; Webster, 3306; App. I.

(g) *Timber Trades Federation, Evidence on behalf of.*—Margerison, 1–310; Hopton, 311–31; App. III., IV.

(h) *Used on Estate.*—Margerison, 301; Havelock, 911–4; Webster, 3204–5.

Tithe.—Selborne, 590; Ramsden, 609–11, 636–40, 689–91; Glanusk, 1404–8; Vernon, 2102–5; Drummond, 2483; Somerville, 3081–5.

Traction Engines.—Margerison, 20, 230–8, 305–8; Havelock, 908–10, 1066–75; Forbes, 1352–3; Robertson, 1652–3; Drummond, 2471, 2474, 2576, 2621–3; App III.

Tramways.—Margerison, 151–3.

Transport (a) *Road* (see also *Traction Engines*).—Margerison, 22, 44–8, 56, 75, 114–23, 145–53, 301–8; Ramsden, 615–7; Havelock, 899, 905–10, 943–7, 1064–5; Glanusk, 1499–508; Robertson, 1638; Vernon, 2092; Schlich, 2376–7; Drummond, 2470; Parry, 3643, 3661–4, 3712–4.

(b) *Rail, see Railways.*

United States: (a) *Clearings in.*—Bailey, 372.

(b) *Imports from.*—Vernon, 2206.

(c) *Improvement of forests.*—App. II. (xiii.), XXV., XXVIII., XXIX.

(d) *Supplies.*—Schlich, 2262–4; App. II. (xi.).

University, see *Education.*

Vernon, A. (Analysis of his Evidence).—Is land agent and surveyor. Has had a long experience of beech woods in the Chilterns, 2073–4. There has been a large reduction in the area under wood in that district during the last half-century, 2075. Beech succeeds best when naturally regenerated, and this system is encouraged as much as possible in Bucks, 2076–80. The gross yield of the beech woods varies from about 15s. to £2 per acre, 2081, 2107–9, 2164–76; the cost would probably be about one-third, 2109, 2165–6. Larch, under suitable conditions, may be even more profitable, 2082. Planting and fencing larch cost £8 per acre on the average, 2083–6. There are large areas which might be brought back to timber cultivation, 2087. Landowners might plant more if they could obtain loans under supervision, but there are difficulties, 2088–9. New plantations should be exempt from rates for 25 years, 2090–1, 2104–5, 2127–34. Improved methods of teaching forestry are required, 2092–3, 2139. Increased facilities for transit are wanted, 2092. Owners and agents should be more technically educated than woodmen, 2093–8, 2142, 2191–3. Woodmen are unable to profit by theoretical training, 2093–8, 2190–3; and learn their duties best in the woods under the agents, 2093. Some of the best beech woods in the Kingdom are in witness's district; they should be cut at regular intervals without lessening the annual quantity, 2096. Head foresters on large estates rank almost with agents, and can profit by education, 2098–9. Foresters are attached to single estates, 2100–1. Tithe and rates together are very heavy, and often double the cost of forming the plantation, 2102–3. Tithe cannot be remitted, 2104–5. Assessment committees generally rate woodlands the same as adjoining agricultural land, whereas it is generally rather worse, 2105. Ash is a very profitable timber, 2106. Is not in favour of State forests, 2110. A State experimental area would be desirable, 2111–2. The area of the beech woods round Wycombe is about 20,000 acres, 2113. Wycombe is the centre of the chair trade, 2114–6; but the district now uses chiefly imported material, and only 10 per cent. of the beech used is produced in the neighbourhood, 2116, 2209–10; although all the produce from the beech woods goes into the chair trade, 2117–8. If the area were extended, the beech would all find a market at Wycombe, 2119–22. The rotation is about 70 years, 2122–4. The maximum cubic capacity is about 2,000 cubic feet per acre, worth about £200, but that was a few large trees, 2125, 2252–4; an ordinary beech wood ought not to be worth more than £60 to £100 per acre to pay best, 2126. In relation to the produce, the rates on existing woods are not high, but are unfair compared with the agricultural land, 2131–4. The management of some of the woods might be improved, 2135–41. Where woods are of sufficient area they should be under a good forester, 2143. His visits to woods abroad have stimulated his interest in forestry, 2144–6. A State demonstration area is desirable, but we could not attain such great examples as abroad, 2147–52; the land in this country is not sufficiently uniform, 2151, 2196–7. There are small industries around Wycombe giving employment and helping to prevent rural depopulation, 2153–8. There is a smaller percentage of land under wood in this than in other countries, 2159. Cannot give an opinion as to the diminution of the timber supply abroad, 2160–1. The cessation of the demand for oak for the Navy has contributed to discourage forestry, 2162. The Hughenden Woods yield about 28s. per acre net, annually, without the stock being reduced, 2164–9, 2176. Similar results are shown by other woods in the district, 2170–2. These woods are naturally regenerated, and the timber taken out regularly, 2173–6, 2255–6. The local "load" of timber is 25 cubic feet, 2177–8. The land under these beech woods, if used for agriculture, would not be worth 10s. per acre, 2179–81. The system followed in these beech woods is one of the Continental systems, 2182. There are instructive examples of well managed woods in this country, 2183–5. Rabbits are kept down, 2186–9. Sheep and cattle are kept out, but pigs are supposed to do good, 2188. An area for demonstration attached to a forest school would be very desirable, 2194–5. There is too much cutting and too little planting in England, 2198–9; the stock of home-grown timber is decreasing while there is an increasing use for it, 2200–1. An estate is more valuable when there is timber on it, 2202–3. Owners have had less capital to spend on planting in late years, 2204–5. The bulk of the foreign timber used at Wycombe is Canadian and American birch, which comes in planks of convenient size, 2206. Chair parts, ready to be made into chairs, are now being sent over from Canada and Sweden; this trade is becoming gigantic, 2206. Prices do not seem to have been lowered, but home-grown wood would have gone up were it not for the imports, 2207. Mahogany and other fine woods are used for certain chairs, 2208. University education is too dear for most; County Council classes would do good. 2211–3. Owners do not plant because they do not get any return for many years, 2214. 100 acres of arable land require three men to work it, of pasture one man; and woods would not require more than one man per 100 acres, 2215, 2220–1, 2245–7; besides the men for felling, 2246–8. Good pasture land should not be broken up into plantations, 2215–6. Would not object to waste lands being gradually afforested by the State; there is too much imported for such State action to affect the price and so compete with private owners, 2217–9. Afforestation of waste lands would give employment, 2220–6. The development of the chair industry was due to the existence of the beech woods, 2113–5, 2209, 2227–8. We might expect industries to be started if there were forests in other out of the way places, 2228–30; but some beech forests in the Alps have only developed fire-wood and a little carving, 2230–1. Full beech-mast years occur every third or fourth year, 2232–4. No preparation of the soil is made to bury the mast, 2234–5. Larch grows well in the district, 2237–41. Quick grown beech sells rather better than slow grown, which is hedgerow timber, and harder to work, 2242. There is never complete canopy in these beech woods, 2243–4. Besides the men engaged in the woods, the chair industry maintains many persons, 2249–50. The beechwood output is 50–60 feet per acre annually, 2250–1. Beech is occasionally sown (not planted) artificially, but not to any great extent, 2255–6.

Appendix IX.—Particulars of beech woods in Bucks approximate values of timber in 1902; and amount of sales of timber during several years on certain estates, with acreage and average price.

Vyrnwy, Lake.—Parry, 3643–728; App. XVII.

Wages, see *Salaries.*

Wales.—Glanusk, 1381–578; Davidson, 2063–5; Schlich, 2362; Drummond, 2453–629; Webster, 3188–91, 3209–62, 3269–73; Parry, 3650–60, 3668–72, 3679–700; App. X.

Ward, Professor H. Marshall. (Analysis of his Evidence).—Professor of Botany, represents the University of Cambridge, 3492–3. Cambridge would be an admirable centre for theoretical instruction in forestry, 3494–5; but there are no forests for practical instruction, 3494–5, 3510–2, 3543. Young plantations could be established in a short time near Cambridge, 3496. Forestry on the Continent is much better than in this country, 3497. It would be preferable to find a forest for illustration in England and Scotland rather than send students abroad to study, 3496. Cambridge would probably not be a good locality to form a demonstration forest, 3498–500. A complete forestry course could be given at Cambridge if combined with tours at home or abroad, 3500–2. Oxford or Cambridge would be the best centre for landowners, 3503–4. The theoretical instruction should be given first and completed by a subsequent technical training in the forest, 3505–6, 3606, 3610–24, 3633. Forestry is an important department of rural economy, 3507–8. There are large tracts of country which might be profitably afforested, 3509. Would not suggest a chair of forestry at Cambridge owing to the lack of forests, 3510. Cambridge is not analogous to Coopers Hill, where there is a large area of wood, tracts of which were until a year ago under the control of the Professor there, 3511–3. It is doubtful how far technical forestry is a subject for university education, 3513–4, 3607–9. There are no forests under the control of Munich University, 3415–7. Cambridge could turn out men ready to become foresters, 3518–20. There is land of sufficiently low value to be suitable forest land near Cambridge, 3521–4. It would take some time to get to Woburn, 3525–6. Model illustrations of planting might be formed near Cambridge, 3527–8. If funds were available, the University would welcome such teaching, 3529–31. Witness would be willing to encourage the study of botany as affecting forestry, 3532–5. Instruction in forestry would be attractive to students, 3504, 3536–40. The forest is the laboratory of the forester and essential to the teaching, 3527, 3541–2, 3551. It would take a long time to establish a complete forest near Cambridge, 3544–6. The students would probably be willing to go abroad, 3547–8. Most of the continental forestry schools have forests attached, 3549–50. There is a model farm for the practical illustration of agriculture at Cambridge, 3552. The training of a forester should be an extension of his training as a botanist, 3553–8. A good forester is impossible unless he is a botanist, 3558–68. A student could obtain a sufficient knowledge of the sciences underlying forestry in two or three years, 3568–71, 3636–7; an equivalent knowledge is successfully given in agriculture now, 3570. He would require two years for the technical training in the forest, 3572–7; but this might partly dovetail in with the theroetical instruction, 3573–4, 3638–40; so that the whole need not occupy more than three to four years, 3574–82, 3641. Botany and other sciences would be taken concurrently, 3569–71, 3583–4. Has not given the details of courses other than botany, 3585. Botany is the most important of the fundamental sciences in forestry, 3586, 3592–3, 3597, 3601–4. A forester should be as thoroughly instructed in entomology as the study of fungi, 3586–7. Some knowledge of mathematics is necessary in forestry, 3588–91, 3594–6, 3598–600. Botany is not the sole foundation of forestry, 3591, 3605. Some zoology should be taught, 3614. Witness's scheme is intended for head foresters, 3625–9; large forests should be under very competent men, 3629. If the teachers could be got the better arrangement would be a forest school for foresters, 3630–1; one teacher of natural science and one of practical forestry for young foresters at such a school would be insufficient, 3632–5.

Appendix XVI.—Outline sketch of forestry course.

Waste lands, see *Afforestation, areas available for.*

Water supplies, afforestation of catchment areas.—Margerison, 76–80; Havelock, 900–1; Glanusk, 1528–30; Davidson, 2032–42; Schlich, 2269, 2308; Drummond, 2536–8; Parry, 3642–728; App. XVII.

Weasels.—Margerison, 300–1; Selborne, 517, 549–50.

Webster, A. D. (Analysis of his Evidence).—Represents the Royal Horticultural Society, 3187; has managed woodlands in England, Wales, and Ireland, 3189–90. One inducement to planting is the high price of timber and the chances of a timber famine, 3188. Plantations can be established on exposed hill sides, 3188. Timber paid well, when laid out for paying, on the Penrhyn Castle estate, 3191–1*. Game and timber do not go together, 3191*, 3208. Witness was trained under his father and had been at a school in connection with forestry, 3193–4. Many foresters would be glad to learn, 3195; but the salary of a forester is too low to make it worth his while, 3195–6, 3201. Foresters should be educated by serving an apprenticeship for three years, and then working in State forests, which should be established on waste lands, with a few forest schools in connection with them, 3188, 3197–9, 3207, 3255–7. Landowners and agents do not know much about forestry, 3200. It is not necessary to train owners and agents, 3202. There is a dearth of competent foresters, because the wages are too low, 3201, 3266–8. The quality of home-grown timber is improving, 3203–4. More timber might be used on the estate than is done at present, 3204–5. Most foresters are not competent to deal with the manufacture, valuation, and transport of timber, 3206. Witness has planted a good deal on Welsh hillsides above Bangor, 3209–13, 3234–6, 3244–9, 3284–5. There were no rights of common on these hillsides, 3214–6. The rent of the ground, for sheep farming, was previously about 5s. per acre, 3216–7. These plantations have sheltered the land so that the farmer can grow crops and keep mixed stock, 3213, 3241–3. There are several plantations, amounting to about 2,000 acres, going up to 1,000 feet, 3218–24. The State should plant in blocks of not less than 300 acres, 3225–6, 3232. It would pay to buy up these high altitudes, 3230–1. The Government would have to buy up the sheep rights, 3227–9. Large areas are available for planting in Wales, 3225–6, 3233, 3237–40. The young men working in the State forests should receive wages, 3233. Sheep farmers would be glad of shelter plantations, 3241–3. Land over 1,300 feet should not be planted, 3250–3. Species which stand against wind were planted on the outsides of plantations, and mixed conifers inside, 3258–60. Witness would not mix the varieties, 3260–2. Many foresters have left their calling because the pay is not high enough, 3201, 3263–8. Foresters have not much knowledge, and there is great need for education, 3266–8. The timber on Lord Penrhyn's estate was sold per lineal yard or per cubic foot, 3269–71. Larch fetched about 1s., 3272–3. Copse woods should be converted into high forest, 3274–80. Witness has had experience of planting bog land in Ireland on the shores of Lough Neagh, 3286–9. These bogs were formerly only used for snipe shooting and cutting turf for fuel, 3290, 3293; the depth goes down to 16 feet, 3291, 3297, 3302–4. It was planted with a general mixture of conifers, 3292. The land was drained, 3294–8. The trees reached an average height of 37–38 feet in 32 years, 3299. The trees succeeded well, 3290, 3300–1. English timber merchants do not care to purchase in Ireland unless they can get a regular supply, 3306. There is no demand for such bog land, 3307–12.

WEISSWASSER, school at.—App. II. (v.).

WOBURN.—Schlich, 2274, 2277; Ward, 3525–6.

WOODLANDS: (*a*) *Area.*—Craigie, 2904–8, 2929–32, 2945–66; App. XIV., XXI.

(*b*) *Condition and management of British.*—Margerison, 57–64; Bailey, 335, 379, 477–85; Selborne, 508; Slater, 747–9; Havelock, 1023–37; Forbes, 1231–4, 1289, 1372–7; Glanusk, 1401, 1417–21; Robertson, 1615–6, 1634–7, 1654–60, 1700–5, 1749–80; Davidson, 1907–11, 1922–9, 2043–8; Vernon, 2135–41, 2198–9; Schlich, 2370–6; Drummond, 2540–8, 2590; Pitcaithley, 2640–3, 2672, 2691–7, 2706–14; Croxford, 2781; Somerville, 3025–37; Michie, 3315, 3322–4; App. I. II., (viii.) (ix.), XI.

WOODMEN, see *Foresters.*

WOOD-PULP.—Bailey, 443–4; App. II. (xi.) (xiii.).

WOODS AND FORESTS, Office of, see *Crown woods.*

WORKING-PLANS.—Margerison, 15–17; Bailey, 335, 2782–6, 2808–27; Selborne, 508–10, 525–30, 568–76; Slater, 872–3; Havelock, 1032–3, 1117–8; Forbes, 1214–7; Robertson, 1714–7; Schlich, 2274, 2293; Pitcaithley, 2695–6, 2725–6; App. I., III., XXV., XXVIII.

WURTEMBERG.—App. XXVI., XXVII.

WYCOMBE chair industry.—Vernon, 2113–22, 2153–8, 2206–10.

YALE University.—App. XXIX.

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